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OIL AND GAS DEVELOPMENTS IN PENNSYLVANIA IN 1978

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Progress Report 192

OIL AND GAS DEVELOPMENTS IN PENNSYLVANIA IN 1978

by Robert G. Piotrowski, Cheryl L. Cozart,
Louis Heyman, John A. Harper, and Kathleen D. Abel
Pennsylvania Geological Survey

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OIL AND GAS DEVELOPMENTS IN PENNSYLVANIA IN 1978

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ABSTRACT

Oil production in 1978 totaled 2,819,742 barrels, 6 percent above the 2,659,414 barrels produced in 1977. Oil reserves decreased from 49,334,000 barrels in 1977 to 48,156,000 barrels in 1978, a 2 percent drop. In 1978, secondary waterflood production in the Bradford field accounted for 59 percent of the statewide oil production. Only one new waterflood project was begun during the year, by Pennzoil Company on their Bingham lease in the Bradford field. Two tertiary projects remained active, the Penn Grade Micellar Displacement project at Derrick City and the experimental Maraflood project at Cyclone. Both of these projects are in the Bradford field. Gas production rose to 97,763 million cubic feet in 1978 from 92,293 million cubic feet in 1977, a 6 percent increase. Gas reserves, including stored recoverable gas, increased from 1,884,932 million cubic feet in 1977 to 2,093,516 million cubic feet in 1978, up 11 percent.

The price of Penn Grade Crude oil was $14.77 per barrel during 1978. The wellhead price paid per thousand cubic feet for natural gas during the year ranged from $0.30 per thousand cubic feet under old contracts to as high as $1.92 per thousand cubic feet in new intrastate contracts. On November 9, 1978, the "Natural Gas Policy Act of 1978" (N.G.P.A.) was signed into law. The law is a revision of Natural Gas Pricing and Regulation. It is a gradual move toward price deregulation in 1985, and provides for specific price increases in the interim. It also places intrastate gas under Federal price controls for the first time.

The total number of wells completed in Pennsylvania in 1978 was 1,748, an increase of 286 wells (20 percent) over 1977. Total footage drilled was 4,581,717, an increase of 32 percent over 1977 (3,461,805 feet). In 1978, 557 oil wells were completed. This is a decrease of 121 wells or 18 percent compared to 1977. The three most active counties in oil well drilling were Venango, Warren, and Forest, where approximately 92 percent of all oil wells were drilled. A total of 1,105 gas wells were completed in 1978, which is an increase of 411 wells or 59 percent over 1977. The five most active counties in gas well drilling were Indiana, Westmoreland, Clearfield, Erie, and Jefferson Counties, where approximately 82 percent of all gas wells were drilled.

Exploratory wells drilled to find and produce hydrocarbons in unproved areas increased from 93 wells comprising 348,926 feet of hole in 1977 to 97 wells comprising 378,486 feet of hole in 1978, an increase of 4 percent in wells and 8 percent in footage. There were 28 gas discoveries and 1 oil discovery in 1978.

Seismic exploration activity increased from 17.99 crew-months in 1977 to 30.95 crew-months in 1978. Seismic crews operated in 19 counties in Pennsylvania during the year.

INTRODUCTION

Pennsylvania oil and gas statistics reported here are based on drillers' records and location plats filed with the Oil and Gas Regulatory Division, now in the Bureau of Topographic and Geologic Survey. Only those wells are reported for which records and plats have been received within the year. This includes wells drilled in prior years for which records were submitted and received in 1978. It does not include 1978 wells for which records had not been submitted within the year. Oil production and reserves data and gas production and reserves data shown in Figures 1 through 7 were obtained from the American Petroleum Institute and the American Gas Association, respectively.

ACKNOWLEDGEMENTS

We appreciate the cooperation of the Oil and Gas Regulatory Division, formerly in the Bureau of Land Protection and Reclamation and now in the Bureau of Topographic and Geologic Survey, Pennsylvania Department of Environmental Resources, in sharing drillers' logs submitted to them by the operators under the oil and gas law.

We also appreciate the help of the Pennsylvania Game Commission; the American Gas Association; the American Petroleum Institute; Petroleum Information Corporation; Pittsburgh Oil Scouts Association; the Division of Minerals of the Bureau of Forestry, Pennsylvania Department of Environmental Resources; and the Bureau of Statistics, Pennsylvania Department of Commerce.

Thanks are extended to all operators and companies who released natural-gas production statistics and other data.

PRODUCTION AND RESERVES

OIL PRODUCTION

In 1978, a total of 2,819,742 bbl (barrels) of oil, worth approximately $41,647,589, was produced from Upper Devonian and Silurian sandstones, compared to 2,659,414 bbl of oil in 1977 worth $38,010,405. Included in that total is the production of crude oil formerly designated as "Corning Grade" from Medina (Lower Silurian) sandstones in Erie and Crawford Counties, amounting to 61,616 bbl, up 24,211 bbl from 1977. All oil produced in Pennsylvania is now designated Penn Grade Crude. Production of natural-gas liquids rose 20 percent in 1978 (Figure 1).

Figure 2 shows the amount of oil production and total number of producing wells, by county. The total oil production in the two figures differs be-

Figure 1. Oil production in Pennsylvania, 1978

	1978	*1977*	*% Change*	*Cumulative to 12/31/78*
	(1,000 barrels)			
Penn Grade	2,820	2,659	+ 6	1,295,043
Natural gas liquids	67	56	+20	- - -

Figure 2. Oil wells and crude oil produced in Pennsylvania in 1977 and 1978, by counties*

	Crude oil production (barrels)		*Number of producing oil wells*	
County	*1978*	*1977*	*12/31/78*	*12/31/77*
Allegheny	50,093	47,162	287	310
Armstrong	8,731	9,759	72	104
Beaver	4,940	4,869	102	93
Butler	67,734	73,404	1,210	1,378
Clarion	25,574	32,516	495	554
Clinton	52	0	1	0
Crawford	59,125	43,541	71	70
Elk	19,134	19,226**	197	143
Erie	1,131	237	14	4
Fayette	0	50	1	2
Forest	109,771	122,810	1,187	888
Greene	24,113	28,611	301	299
Indiana	521	484	2	1
Jefferson	3,191	3,614	29	29
McKean	1,065,339	1,224,384**	12,442	12,734
Mercer	994	1,283	86	106
Potter	14,461	13,984	80	78
Venango	550,197	577,474	6,879	6,924
Warren	473,421	458,641**	3,757	4,105
Washington	85,963	87,414	555	578
Total	2,564,485	2,749,463**	27,768	28,400

*Compiled by the Pennsylvania Department of Commerce, Bureau of Statistics

**Revised figures

cause Figure 1 is based on actual oil produced whereas Figure 2 is based on oil shipped or sold. The leading counties for oil production in 1978 were McKean, Venango, and Warren Counties, which together produced approximately 81 percent of the total oil produced in Pennsylvania.

OIL RESERVES

Total net proved reserves of oil in the Commonwealth at the end of 1978 decreased 2 percent from 1977. The counties that had the greatest reserves were McKean, Venango, and Warren. Production exceeded the new reserves added in all counties. Reserves of natural-gas liquids fell 17 percent. Figure 3 summarizes proved reserves in 1978 and 1977.

Figure 3. Oil reserves in Pennsylvania, 1978

	1978	*1977*	*% Change*
	(1,000 barrels)		
Total oil	48,156	49,334	− 2
Natural gas liquids	323	390	− 17

SECONDARY AND TERTIARY OIL RECOVERY PROJECTS

Twenty-one service wells were drilled in 1978, compared to 8 in 1977. This includes 5 gas-storage observation wells in Clinton County and 16 water- or gas-injection wells in Forest, Warren, Venango, and McKean Counties. Waterflood development in the Bradford field has decreased substantially in the past two years. Figure 4 shows how much of Pennsylvania's previous production was due to secondary recovery, and that the Bradford field accounted for the majority. In 1978, waterflood production in the Bradford field was 59 percent of the total statewide production.

One new waterflood project was undertaken in 1978. This project is the Bingham Lease waterflood operated by Pennzoil. It covers approximately 275 acres in the Bradford field and is located just north of the town of Cyclone, McKean County. The reservoir is the Bradford Third Sand. The Penn Grade Micellar Displacement Project at Derrick City, a joint effort of Pennzoil, Witco, Quaker State, and the U.S. Department of Energy for tertiary oil recovery from the Bradford field, is reported to be progressing satisfactorily. Injection of the micellar solution was begun in 1977 and continued through 1978. The project consists of 24 acres, within which are 16 input and 25 producing wells on 1.5 acre spacing; the reservoir is the Bradford Third Sand. The experimental Maraflood project in the tight Bradford Sandstone in the Bradford field at Cyclone, jointly sponsored by Pennzoil and Witco, is in a late stage and water injection is continuing.

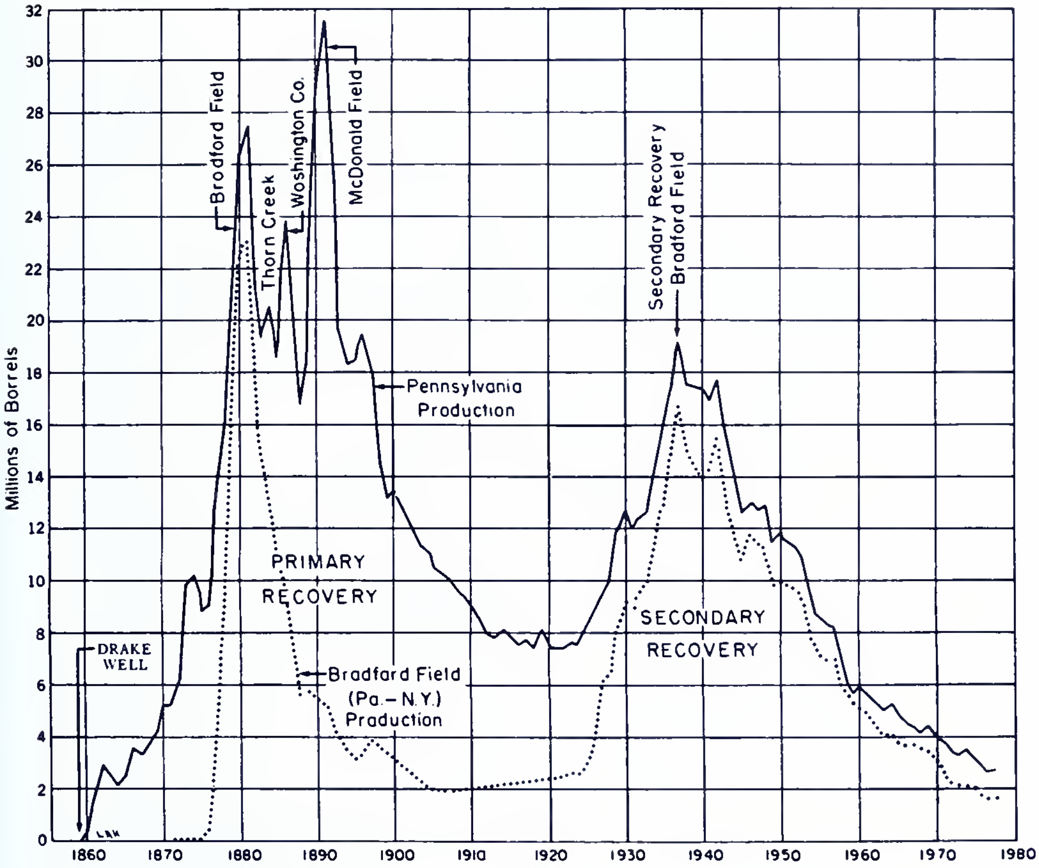

Figure 4. Annual production of crude oil in Pennsylvania

GAS PRODUCTION

Gas production in 1978 rose 6 percent over 1977; 97,763 million cubic feet as compared to 92,293 million cubic feet. There is a wide disparity between highest and lowest wellhead price for gas. It is estimated, however, that the total value of the gas produced was $84,076,000. The number of producing gas wells increased to approximately 18,900 at the end of 1978 from approximately 17,900 producing wells at the end of 1977. Figure 5 gives an overview of gas production for 1978, compared to 1977.

GAS RESERVES

The total proved recoverable reserve of natural gas rose 11 percent over 1977, and stored recoverable gas rose 5 percent (Figure 6). Figure 7 is a graph showing production, consumption, and reserves of natural gas in Pennsylvania.

Figure 5. Gas production in Pennsylvania, 1978

	1978	*1977*	*% Change*	*Cumulative to 12/31/78*
	(millions of cubic feet)			
Shallow gas[1]	84,485	80,280*	+ 5	- - -
Deep gas[2]	13,278	12,013*	+ 10	- - -
Total gas	97,763	92,293	+ 6	9,203,616

[1] Shallow gas: from Upper Devonian or younger rocks; generally less than 4,000 feet deep.

[2] Deep gas: from Middle Devonian or older rocks; generally more than 4,000 feet deep.

* Revised figures

Figure 6. Gas reserves in Pennsylvania, 1978

	1978	*1977*	*% Change*
	(millions of cubic feet)		
Total gas	2,093,516*	1,884,932*	+ 11
Stored recoverable gas	582,260	556,264	+ 5

* Includes stored recoverable gas

GAS STORAGE FIELDS

Gas storage fields have been created throughout Pennsylvania to accumulate gas during low-demand periods for use during high-demand periods.

Storage capacity at the end of 1978 was 641,999,641 thousand cubic feet, a decrease of 115,860,359 thousand cubic feet from 1977. Recoverable gas in storage in 1978 was 582,260,406 thousand cubic feet compared to 556,264,000 thousand cubic feet in 1977. Figure 8 is a map showing the locations and names of all active gas storage fields in Pennsylvania.

OIL AND GAS PRICES

Practically all oil production in Pennsylvania is classified as stripper production (less than 10 barrels per well per day). The stripper price for Penn Grade was $14.77 per barrel during 1978.

The wellhead price paid per thousand cubic feet for natural gas during the year ranged from $0.30 in old contracts to as high as $1.92 per thousand for new gas delivered as intrastate gas. The wellhead price of interstate gas ranged up to $1.68 for new gas, including B.T.U. adjustment under Federal Power Commission opinion 770, amended by 770-A.

The "Natural Gas Policy Act of 1978" (N.G.P.A.) was signed by President Carter on November 9, 1978. It is a comprehensive revision of the national policy concerning natural gas pricing and regulation. The Act is a

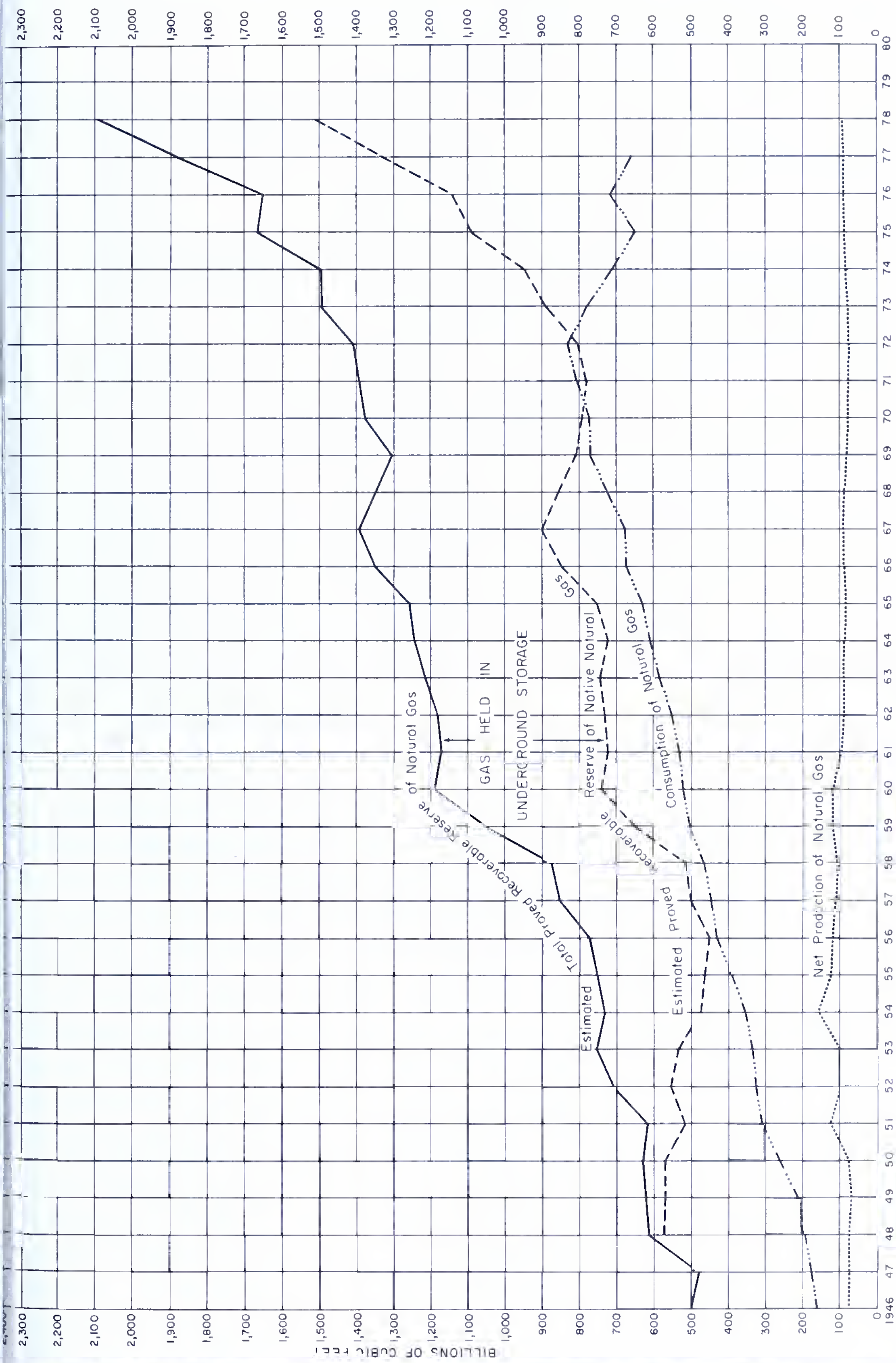

Figure 7. Production, consumption, and reserves of natural gas in Pennsylvania

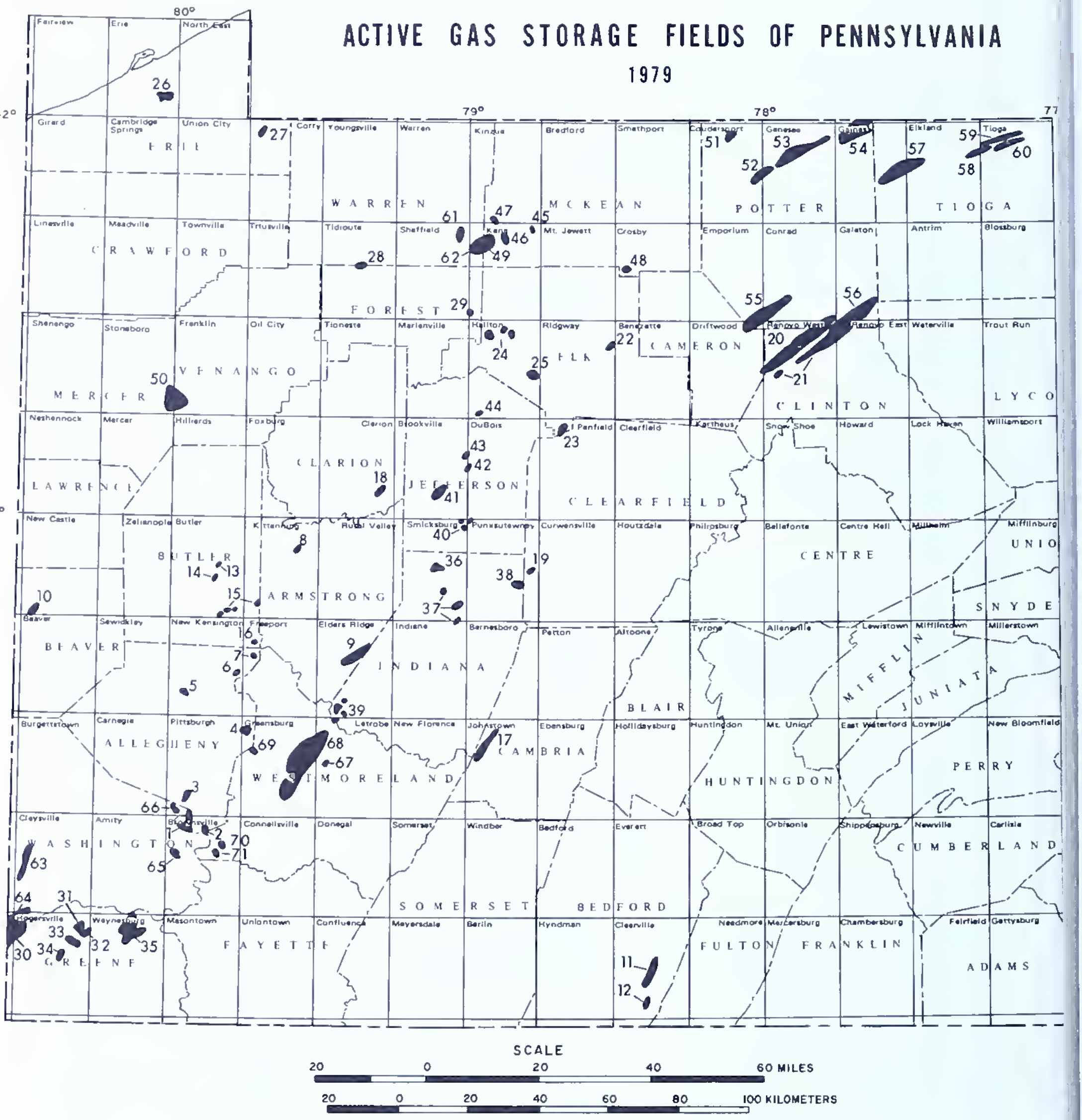

Figure 8. Active gas storage fields of Pennsylvania

NAMES OF ACTIVE GAS STORAGE FIELDS IN PENNSYLVANIA

ALLEGHENY COUNTY

1. Bunola
2. Gamble Hayden
3. Tepe
4. Murrysville
5. Mt. Rayal
6. Tarentum
7. Smith Parke

ARMSTRONG COUNTY

8. Fair and Helm
9. South Bend

BEAVER COUNTY

10. Black Hawk

BEDFORD COUNTY

11. Artemas and Five Farks
12. Artemas-Artemas

BUTLER COUNTY

13. Vardy
14. Partman
15. Saxanburg
16. Hughes

CAMBRIA COUNTY

17. Rager Mountain

CLARION COUNTY

18. Truittsburg

CLEARFIELD COUNTY

19. Gaurley-Miller

CLINTON COUNTY

20. Leidy
21. Tamarack-Dawns

ELK COUNTY

22. St. Marys
23. Baane Mountain
24. Owls Nest
25. Belmauth

ERIE COUNTY

26. Meade
27. Carry

NAMES OF ACTIVE GAS STORAGE FIELDS IN PENNSYLVANIA

(Continued)

FOREST COUNTY

28. Queen
29. Duhring

GREENE COUNTY

30. Mojarsville
31. Swarts West
32. Swarts
33. Hunters Cave
34. Halbrook
35. Pratt

INDIANA COUNTY

36. Alabran
37. Kinter
38. Clork
39. Schmidt

JEFFERSON COUNTY

40. Sprankle
41. Galbraith
42. Iawa
43. Markle
44. Munderf

McKEAN COUNTY

45. Meod Run
46. Keelar
47. Swede Hill
48. Wellendarf
49. East Branch "B"

MERCER COUNTY

50. Henderson

POTTER COUNTY

51. Shoran
52. Hebron
53. Ellisburg
54. Harrisan
55. Whartan
56. Greenlick

TIOGA COUNTY

57. Sobinsville
58. Palmer
59. Tioga
60. Meeker

WARREN COUNTY

61. Deerlick
62. East Branch "A"

WASHINGTON COUNTY

63. Donegal
64. Heard
65. Calvin
66. Finleyville

WESTMORELAND COUNTY

67. Seonar
68. Ookford
69. Trofford
70. Webster
71. Patton

gradual move toward price deregulation of newly discovered natural gas by 1985, and provides for specific price increases for all categories of natural gas in the interim. Further, intrastate gas is put under Federal price controls for the first time.

The N.G.P.A. divides gas-pricing categories into two broad groupings: (1) gas under interstate contracts when the act was passed, and (2) gas not under contract at that time (Figure 9).

Pricing of gas in interstate commerce when the N.G.P.A. was passed remains set at the "just and reasonable" rates established by the Federal Energy Regulatory Commission or its predecessor, the Federal Power Commission.

Producers can collect prices up to ceilings set by the N.G.P.A. for gas not under interstate contract when the Act was passed. These prices are maximum prices, and a lower price is allowable depending upon the supply-and-demand situation. Producers are required to apply to state agencies for determinations that gas qualifies for pricing under one of four categories. In Pennsylvania, this agency is the Oil and Gas Regulatory Division of the Bureau of Topographic and Geologic Survey in the Department of Environmental Resources. State agency determinations are subject to review by the Federal Energy Regulatory Commission. Applications for pricing determinations must be made on a well-by-well basis, and the burden of proof for eligibility of price lies upon the producer.

Figure 9. Gas price ceilings under Natural Gas Policy Act of 1978*

Gas requiring well-category determinations

NGPA section	Gas category	Maximum lawful price for deliveries made in: Dec. 1978	Jan. 1979	Feb. 1979	Mar. 1979	Apr. 1979
		cost per million British Thermal Units				
102	New natural gas	2.078	2.096	2.116	2.136	2.156
103	Gas from new onshore production wells	1.969	1.980	1.993	2.006	2.019
107	High-cost gas	2.078	2.096	2.116	2.136	2.156
108	Gas from stripper wells	2.224	2.243	2.264	2.285	2.306
109	Not otherwise covered	1.630	1.639	1.650	1.661	1.672

Gas in interstate commerce on November 8, 1978

NGPA section	Gas category	Type of sale or contract	Maximum lawful price for deliveries made in: Dec. 1978	Jan. 1979	Feb. 1979	Mar. 1979	Apr. 1979
			cost per million British Thermal Units				
104	Post-1974 gas	All producers	1.630	1.639	1.650	1.661	1.672
	1973-74 gas	Small producer	1.379	1.387	1.396	1.405	1.414
		Large producer	1.058	1.064	1.071	1.078	1.085
	Replacement contract gas or recompletion gas	Small producer	0.771	0.775	0.780	0.785	0.790
		Large producer	0.593	0.596	0.600	0.604	0.608
	Flowing gas	Small producer	0.393	0.395	0.398	0.401	0.404
		Large producer	0.332	0.334	0.336	0.338	0.340
	Certain Appalachian Basin gas	North subarea contracts dated after 10/7/69	0.368	0.370	0.372	0.374	0.376
		Other contracts	0.344	0.346	0.348	0.350	0.352
106(a)	Interstate rollover gas	Small producer	0.701	0.715	0.715	0.715	0.715
		Large producer	0.603	0.607	0.611	0.615	0.619

* Prices reflect monthly adjustments for inflation and real growth factors in categories where such adjustments apply.

1978 DRILLING AND COMPLETIONS

TOTAL COMPLETIONS

The total number of all wells completed in Pennsylvania in 1978 was 1,748 wells, including 41 wells drilled deeper. This is an increase of 286 wells (20 percent) over 1977. The total footage drilled was 4,581,717 feet, an increase of 1,119,912 feet (32 percent) over 1977. The average depth per well was 2,621 feet. The seven most active counties, in order of importance, were

Figure 10. New well completions and old wells drilled deeper in Pennsylvania, 1978

NEW WELL COMPLETIONS

County	*No. of wells*	*Average total depth (feet)*
Allegheny	15	3,372
Armstrong	59	3,597
Beaver	2	2,579
Blair	2	5,331
Butler	5	1,507
Cambria	5	4,713
Centre	1	13,052
Clarion	19	2,134
Clearfield	133	3,704
Clinton	5	1,602
Crawford	6	4,169
Elk	3	2,634
Erie	115	2,845
Fayette	23	4,016
Forest	81	1,282
Greene	13	1,075
Indiana	395	3,701
Jefferson	104	3,443
Lawrence	3	676
Luzerne	1	2,825
Lycoming	3	5,492
McKean	44	1,886
Mercer	18	4,006
Potter	3	3,136
Somerset	4	7,041
Venango	272	792
Warren	208	1,196
Washington	26	3,502
Westmoreland	139	3,835
Total	1,707	2,669

OLD WELLS DRILLED DEEPER

County	*No. of wells*	*Average amt. deepened (feet)*
Allegheny	2	1,031
Armstrong	1	1,691
Clarion	2	683
Clearfield	3	740
Elk	2	49
Fayette	1	66
Indiana	23	648
Jefferson	7	435
Total	41	621

Indiana, Venango, Warren, Westmoreland, Clearfield, Erie, and Jefferson, where approximately 80 percent of all wells were drilled (Figure 10).

OIL COMPLETIONS

The total number of oil wells completed in Pennsylvania in 1978 was 557 wells. This is a decrease of 121 wells (18 percent) over 1977. The total footage drilled was 579,780 feet, a decrease of 137,185 feet (19 percent) over 1977. The average depth per well was 1,041 feet. The three most active counties, in order of importance, were Venango, Warren, and Forest, where approximately 92 percent of all oil wells were drilled (Figure 11).

Figure 11. New oil well completions in Pennsylvania, 1978

County	*No. of wells*	*Average initial production (bopd)**	*Average total depth (feet)*
Beaver	1	1	1,814
Butler	3	2	1,431
Forest	58	19	1,108
Jefferson	1	4	1,020
Lawrence	1	1	246
McKean	38	6	1,905
Venango	263	15	789
Warren	189	40	1,163
Washington	3	115	2,896
Total	557	24	1,041

* bopd = barrels of oil per day

GAS COMPLETIONS

The total number of gas wells completed in Pennsylvania in 1978 was 1,105 wells, including 40 wells drilled deeper. This is an increase of 411 wells (59 percent) over 1977. The total footage drilled was 3,794,511 feet, an increase of 1,310,250 feet (53 percent) over 1977. The average depth per gas well was 3,434 feet. The five most active counties, in order of importance, were Indiana, Westmoreland, Clearfield, Erie, and Jefferson, where approximately 82 percent of all gas wells were drilled (Figure 12).

COMBINATION OIL AND GAS WELL COMPLETIONS (not reported separately as oil or gas)

This classification comprises those wells that are primarily oil wells but that also produce 100,000 or more cubic feet of gas per day. Because most

Figure 12. New gas well completions and old wells drilled deeper in Pennsylvania, 1978

NEW GAS WELL COMPLETIONS

County	*No. of wells*	*Average initial open flow (Mcfgpd)**	*Average total depth (feet)*
Allegheny	10	191	3,799
Armstrong	59	402	3,597
Blair	1	49	3,517
Butler	1	5	1,520
Cambria	5	778	4,713
Clarion	19	72	2,134
Clearfield	126	588	3,691
Crawford	2	413	4,155
Elk	2	144	2,729
Erie	114	890	2,848
Fayette	23	425	4,016
Forest	11	231	1,777
Greene	12	21	1,105
Indiana	394	841	3,691
Jefferson	100	551	3,503
Lycoming	2	28	4,778
McKean	1	552	1,806
Mercer	13	1,099	4,767
Potter	2	52	1,865
Somerset	3	2,317	9,018
Venango	2	33	994
Warren	8	20	1,864
Washington	20	739	3,607
Westmoreland	135	577	3,888
Total	1,065	678	3,540

OLD GAS WELLS DRILLED DEEPER

County	*No. of wells*	*Average initial open flow (Mcfgpd)**	*Average amount deepened (feet)*
Allegheny	1	1,246	723
Armstrong	1	213	1,691
Clarion	2	14	683
Clearfield	3	1,677	740
Elk	2	176	49
Fayette	1	11	66
Indiana	23	788	648
Jefferson	7	519	435
Total	40	716	603

* Mcfgpd = thousand cubic feet of gas per day

oil wells completed in Pennsylvania are drilled in partially depleted reservoirs, most produce only very small amounts of gas with the oil. Therefore, this category includes only a small number of wells. In 1978, 15 oil-and-gas wells were completed, whereas in 1977, 10 such wells were completed (Figure 13).

Figure 13. New combination oil and gas well completions in Pennsylvania, 1978

County	*No. of wells*	*Average initial open flow (Mcfgpd)**	*Average initial production (bopd)***	*Average total depth (feet)*
Crawford	3	1,167	11	4,083
Erie	1	700	5	2,530
Forest	7	216	40	1,878
Warren	4	125	66	1,267
Total	15	414	39	2,199

* Mcfgpd = thousand cubic feet of gas per day
** bopd = barrels of oil per day

DRY COMPLETIONS

The total number of dry holes drilled in Pennsylvania in 1978 was 50, including 1 old well drilled deeper and completed dry. This compares to 72 dry-hole completions in 1977, including 2 old wells drilled deeper and completed dry. The footages are 148,760 in 1978 compared to 223,628 in 1977. Figure 14 shows the number of dry holes drilled and deepened in 1978.

MISCELLANEOUS COMPLETIONS

Comprised under this heading are stratigraphic or core tests, which are holes drilled basically for subsurface information; water-input wells for secondary recovery by waterflood operations; air- or gas-injection wells for secondary oil recovery by air or gas drive; water-supply wells for waterfloods; liquid-waste-disposal wells; and gas-storage observation wells. Fluctuations in this category are usually not significant as an indicator of general activity. In 1978, 21 miscellaneous wells were completed, compared to 8 in 1977 (Figure 15).

DRILLING AND PRODUCTION ACTIVITY

(classified as shallow or deep)

Drilling and production in Pennsylvania is classified by the Pennsylvania Geological Survey as follows: (1) shallow, based on reservoirs in rock

Figure 14. New dry-hole completions and old wells drilled deeper but completed dry in Pennsylvania, 1978

NEW DRY-HOLE COMPLETIONS

County	*No. of dry holes*	*Average total depth (feet)*
Allegheny	5	2,516
Beaver	1	3,343
Blair	1	7,145
Butler	1	1,720
Centre	1	13,052
Clearfield	7	3,924
Crawford	1	4,452
Elk	1	2,445
Forest	1	4,073
Greene	1	716
Indiana	1	7,870
Jefferson	3	2,231
Lawrence	2	891
Luzerne	1	2,825
Lycoming	1	6,920
McKean	3	1,915
Mercer	5	2,026
Potter	1	5,680
Somerset	1	1,112
Venango	3	890
Warren	1	579
Washington	3	3,407
Westmoreland	4	2,050
Total	49	3,009

OLD WELLS DRILLED DEEPER, COMPLETED DRY

County	*No. of dry holes*	*Average amt. deepened (feet)*
Allegheny	1	1,339

Figure 15. Service well completions in Pennsylvania, 1978

County	*No. of wells*	*Average total depth (feet)*
Clinton	5	1,602
Forest	4	704
McKean	2	1,527
Venango	4	855
Warren	6	1,396
Total	21	1,223

formations of Pennsylvanian, Mississippian, and Upper Devonian age, generally less than 4,000 feet deep, and (2) deep reservoirs, which are in rock formations of Middle Devonian or older age, generally over 4,000 feet deep.

The shallow reservoirs generally produce both oil and gas; the deep almost entirely gas. Figure 16 is a graph showing the shallow-well activity from 1950 to 1978.

The Medina (Lower Silurian) sandstones of Erie and Crawford Counties are usually less than 4,000 feet deep. They produce a small amount of oil

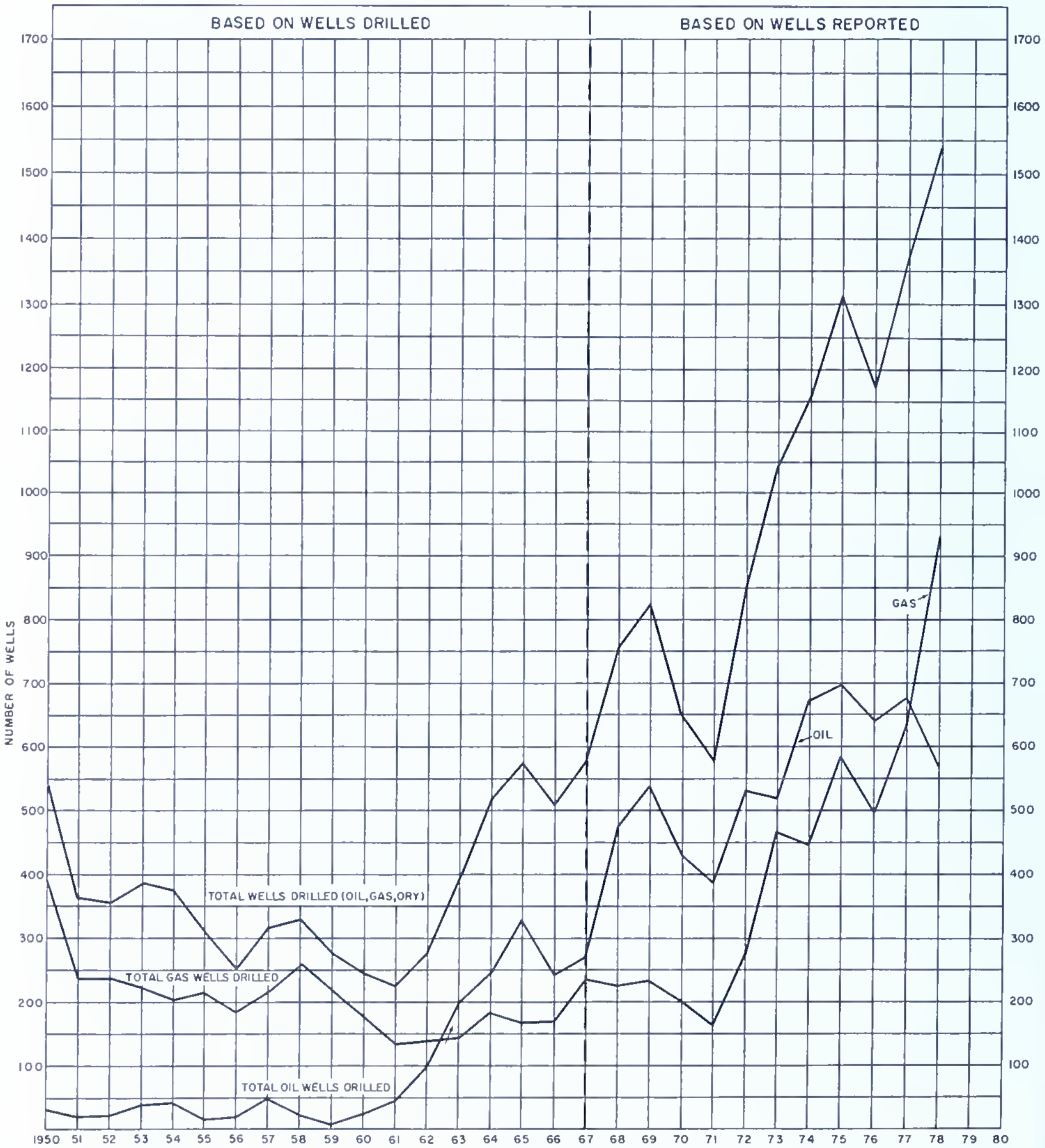

Figure 16. Shallow well activity, 1950-1978 (Upper Devonian or younger; generally less than 4,000 feet)

with the gas and are regarded as deep horizons due to their geologic age. This exception is restricted to the northwest corner of the Commonwealth.

Deep drilling was up from 58 wells in 1977 to 148 wells in 1978. Erie County, where 111 such wells were drilled, was the most active deep drilling area; 110 of the wells were gas wells and one was a combination oil and gas well. Figure 17 is a graph showing the annual rate of deep exploration and development from 1930 to 1978.

The Amoco #1 Svetz, drilled in Somerset County in 1974 to 21,460 feet, is still the deepest penetration in the Appalachian Basin. Figure 18 shows 1978 well completions divided into Upper Devonian and younger and Middle Devonian and older wells.

A total of 13,278 million cubic feet of gas and 61,616 barrels of oil was produced from deep reservoirs in 1978. A summary by field and pool of deep gas production in 1978 and the cumulative production from these reservoirs is given in Figure 19. The producing depth record still stands at 11,458 feet from the Tuscarora (Lower Silurian) sandstone in Summit field, Fayette County.

OTHER ACTIVITIES RELATED TO OIL AND GAS DEVELOPMENTS

GEOPHYSICAL ACTIVITY

The principal nondrilling exploratory tool used in Pennsylvania is the exploration seismograph, which can give approximate to excellent indications of the attitude of the rocks at depth by measuring the time of travel of vibrations to and from the surface. The principal technique now in use in Pennsylvania is Vibroseis, wherein seismic pulses are generated at the surface by mechanical means, rather than by using explosives in very shallow drill holes. The work is usually done by contract crews, and the intensity of activity is gauged by the number of crew-months of operations. Seismic exploration was up from 17.99 crew-months in 1977 to 30.95 crew-months in 1978, and practically all crews used Vibroseis. Seismic surveys were reported in Blair, Butler, Cameron, Centre, Clarion, Clinton, Columbia, Fayette, Forest, Lycoming, McKean, Mercer, Montour, Somerset, Sullivan, Union, Venango, Warren, and Westmoreland Counties. Four seismic-survey permits were issued by the Department of Environmental Resources for evaluation of State Forest lands in the Forbes, Moshannon, and Sproul State Forests in Centre, Clinton, and Somerset Counties. The data indicate a significant increase in activity.

ACTIVITIES ON STATE LANDS

At the end of 1978, there were 47 active oil and/or gas leases on Pennsylvania Game Commission lands totaling 63,755 acres. This compares to 37

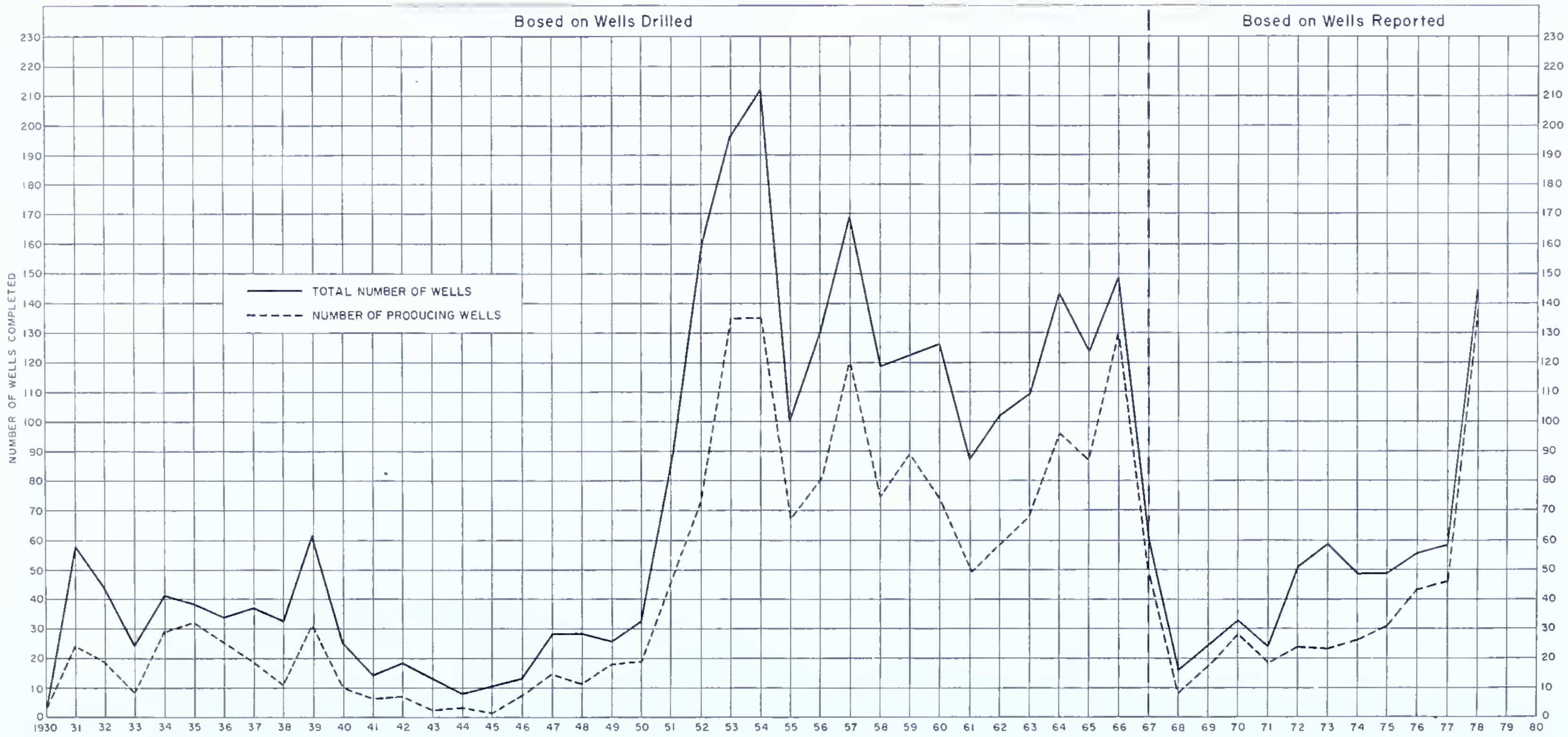

Figure 17. Annual rate of deep sand exploration and development, 1930-1978 (Middle Devonian or older producing horizons; generally more than 4,000 feet)

Figure 18. Drilling and completion of wells reported, 1978 (according to geologic age and depth of producing horizons)

Shallow — Upper Devonian and younger	
NEW WELLS	
Gas	930
Oil	557
Oil and gas	11
Dry	40
Total	*1,538*
DEEPENED WELLS	
Gas	40
Dry	1
Total	*41*
MISCELLANEOUS WELLS	
Service	*21*
Deep — Middle Devonian and older	
NEW WELLS	
Gas	135
Oil and gas	4
Dry	9
Total	*148*
TOTAL ALL WELLS DRILLED	*1,748*

active leases in 1977 totaling 35,593 acres. During the year, 32,121 acres of additional Game Commission lands were put under lease. This included 6 tracts totaling 18,708 acres in Centre County and 5 tracts totaling 13,413 acres in Sullivan County. One tract totaling 3,959 acres in Somerset County expired. There were 41 producing gas wells on 12 of the leases. The total production for 1978 from these wells was 576,690 thousand cubic feet of gas. One lease produced 43.03 barrels of oil.

In 1978, income from oil and gas activities on State Forest lands totaled $3,452,807. These monies were obtained from production royalties, gas-storage and exploration acreage rentals, pipeline rights of way and seismic permits. Of this total, royalty payments for the year amounted to $37,628 for 409,465 thousand cubic feet of gas. Rentals for existing wildcat (exploratory) acreage and past leasing programs totaled $2,912,824, and storage rentals were $489,157. The large amount of income from land rentals was the result of several successful oil and gas lease sales after the October 1977 discovery of the Amoco #1 Texasgulf, Inc. well in Centre County. Other income for pipeline rights of way, compressor station (location) rentals, and seismic surveys totaled $13,197.

During the year, 42,367 acres of additional State Forest lands was leased in two sales. Lands offered for bid in December 1977 but placed under lease in January 1978 totaled 22,656 acres. The bonus bid for the acreage aver-

Figure 19. Gas production from rocks of Middle Devonian or older age in Pennsylvania, 1978

County	Field	Pool	Discovery date	Cumulative production at end of 1977 (in Mcf*)	Production 1978 (in Mcf*)	Cumulative production at end of 1978 (in Mcf*)	Status of field or pool at end of 1978
Armstrong	Goheenville	Snyderville	10/23/70	234,590	18,383	252,973	Producing
	Roaring Run	Roaring Run Oriskany	12/14/70	5,656,960	582,846	6,239,806	Producing
Cambria	Patton	Burley	1/15/69	234,307	34,979	269,286	Producing
		Pindleton	6/30/69	4,272,826	221,132	4,493,958	Producing
Cameron.	Canoe Run		8/24/73	869	105	974	Abandoned/1978
	East Emporium	Salt Run	11/18/71	2,966,514	401,623	3,368,137	Producing
Cameron and Elk	Whippoorwill		7/10/61	15,552,455	136,613	15,689,068	Producing
Cameron, Elk, Jefferson, Clearfield, and Indiana . .	Punxsutawney-Driftwood	*TOTAL*	*9/15/51*	*487,558,192*	*1,288,404*	*488,846,596*	*Producing and shut-in*
		Benezette	1/ 5/53	248,754,688	323,252	249,133,127	Producing
		Driftwood	9/15/51		55,187		Producing
		Boone Mt.	9/18/58	105,055,914	201,818	105,257,732	Gas storage and producing
		DuBois	1/ 6/60				
		Sabula	8/26/63	972,212	18,374	990,586	Producing
		Helvetia	5/11/60	128,490,487	126,099	129,175,344	Producing
		Reed-Deemer	12/ 1/53				Shut-in, abandoned, and producing
		Rockton	2/25/55		558,758		
		Hicks Run	6/ 7/56	4,284,891	4,916	4,289,807	Producing
Clearfield	Beech Run	Anderson Creek	9/25/75	42,798	10,898	53,696	Producing
	Boone Mt.	Moshannon	9/15/76	14,347	10,616	24,963	Producing
	West Decatur		3/30/73	1,838,196	796,027	2,634,223	Producing
Clinton and Potter . . .	Leidy	*TOTAL*	*1/ 9/50*	*160,272,816*	*28,994*	*160,301,810*	*Gas storage and producing*
		Ole Bull	1/ 9/59	5,472,784	28,994	5,501,778	Producing and shut-in

Crawford	Athens		9/20/74				Shut-in
	Cambridge Springs		1/31/76	74,871	0	74,871	Shut-in
	Geneva	Greenwood	10/31/73				Shut-in
	Sparta	Eastman Hill	10/30/75				Shut-in
Crawford and Erie	Conneaut	*TOTAL*	*2/11/57*	*37,802,096*	*1,188,807*	*38,990,903*	*Producing and abandoned*
		Bushnell-Lexington	12/31/58	16,361,468	471,635	16,833,103	Producing and abandoned
		Forro	1/ 4/58	0	15,138	15,138	Producing
		Indian Springs	9/11/57	14,640,183	208,755	14,848,938	Producing
		Kastle	7/14/62	0	340,000	340,000	Producing
		Lundys Lane	11/ 9/61	2,349,788	136,737	2,486,525	Producing
		Pierce	12/31/58	845,616	16,542	862,158	Producing
		West Mead	7/ 8/74	9,557	0	9,557	Shut-in
Elk	Benzinger		11/ 7/72				Shut-in
	Horton	Boot Jack	9/20/73	11,275	0	11,275	Shut-in
Erie	Alder Run		10/30/75				Abandoned/1978
	Corry	*TOTAL*	*4/29/47*	*1,062,094*	*5,338*	*1,067,432*	*Gas storage and producing*
		Beaver Dam	5/20/53	208,394	5,338	213,732	Producing
	Erie Deep	*TOTAL*	*3/21/77*	*141,489*	*212,838*	*354,327*	*Producing and shut-in*
		Blass	12/20/57				Shut-in
		Charter Oaks	5/19/77	2,640	36,866	39,506	Producing and shut-in
		Erie	8/30/77	0	700	700	Producing
		Fairview	3/12/76	35	1,033	1,068	Producing
		Glenwood	8/ 9/77	3,548	16,000	19,548	Producing
		Harborcreek	10/20/77	0	75,426	75,426	Producing
		McKean	1/19/73	135,266	295	135,561	Producing
		Waterford	3/21/77	0	82,518	82,518	Producing and shut-in
	New Ireland		5/14/78				Production not available
	Northeast Deep	*TOTAL*	*10/17/60*	*221,403*	*523,737*	*745,140*	*Producing*
		Bull Reservoir	9/17/72	18,947	13,968	32,915	Producing
		Burgess	10/17/60	167,441	174,504	341,945	Producing
		Hornby	6/10/78	0	1,451	1,451	Producing
		Orchard Beach	2/ 8/74	35,015	333,814	368,829	Producing

Figure 19. (Continued)

County	Field	Pool	Discovery date	Cumulative production at end of 1977 (in Mcf*)	Production 1978 (in Mcf*)	Cumulative production at end of 1978 (in Mcf*)	Status of field or pool at end of 1978
Fayette	Feik		8/ 8/63	0	561	561	Producing
	Highhouse	Woodside	3/10/75				Shut-in
	Mill Run		8/17/78				Shut-in
	Ohiopyle		12/28/59	4,325,437	61,285	4,386,722	Producing
	Sandy Creek		8/ 8/63				Shut-in
		Quebec Run	6/31/69	0	10,743	10,743	Producing
	Spruell		10/31/61	5,747,103	538,698	6,285,801	Producing
	Summit	*TOTAL*	*3/24/38*	*43,762,334*	*190,405*	*43,952,739*	*Producing and abandoned*
		East Summit	12/30/60				Shut-in
		North Summit	3/24/38	21,467,587	61,458	21,529,045	Producing
		South Summit	5/ 9/42	22,267,597	128,947	22,396,544	Producing
Indiana	Cherry Hill	Crichton	1/ 9/63	2,971,788	38,882	3,013,170	Producing
		Hadden	7/11/63		2,500		Producing
	Jacksonville	Tannery	9/21/56	29,435,101	169,290	29,604,391	Producing
	Nolo		9/30/56	13,736,368	55,771	13,792,139	Producing
	Strongstown	*TOTAL*	*6/19/54*	*13,146,443*	*3,643,468*	*16,789,911*	*Producing*
		Lizowitz	6/19/54	6,791,082	1,502,774	8,293,856	Producing
		Pineton	12/20/69	6,355,361	2,140,694	8,496,055	Producing
Jefferson	Frostburg	Elk Run	6/30/65	47,545,667	348,233	47,893,900	Producing
	Markton		11/25/75	0	13,157	13,157	Producing
Lycoming	Salladasburg		6/24/76	0	9,147	9,147	Producing and shut-in
McKean	Bradford	Cyclone	2/18/74	648,976	157,265	806,241	Producing
		Minard Run	1/10/75	0	10,000	10,000	Producing
	Corydon		9/ 8/72				Shut-in
Mercer	Henderson	Kilgore	10/26/66				Production not available
	Maysville		11/11/77				Shut-in
	Sharon		2/26/77				Shut-in
	Sheakleyville	Fleck	8/27/75				Abandoned/1978
	Wheatland		7/24/63	239,234	17,740	256,974	Producing and shut-in

		Newfield	4/ 2/63	[illegible]	58,745	[illegible]	Producing
Somerset.	Boswell	*TOTAL*	*11/11/58*	*11,924,986***	*203,244*	*12,128,230*	*Producing*
		Boswell	11/11/58	10,900,000	22,016	10,922,016	Producing
		Edie	10/18/68	4,246	11,488	15,734	Producing
		Snyder	6/16/60	1,020,740	169,740	1,190,480	Producing
	Heckman Hollow		8/16/77				Shut-in
	Shade Creek		10/ 3/77				Shut-in
	Shanksville		9/22/73	0	874,183	874,183	Producing
	Somerset West		1/ 6/78	0	22,945	22,945	Producing
Venango.	Barkleyville	Duncan	4/ 5/73	102,680	4,526	107,206	Producing
	Franklin-Oak Forest	Galloway	11/12/73	39,067	8,504	47,571	Producing
	Wesley	Irwin	12/ 1/72	188,335	52,628	240,963	Producing
Warren.	Sugar Grove	Pettigrew	5/29/70				Shut-in
		Whites Run	10/30/75				Shut-in
Washington	Daniels Run	Glyde	9/ 6/61	126,667	4,776	131,443	Producing
Westmoreland	Blairsville	Kahl	10/23/62	10,396,901	222,238	10,619,139	Producing
	Jacobs Creek	Bailey	12/26/61	1,902,982	105,165	2,008,147	Producing
	Latrobe	Dry Ridge	8/25/46	5,662,717	119,323	5,782,040	Producing
	Lycippus	*TOTAL*	*8/17/49*	*6,531,366*	*56,266*	*6,587,632*	*Producing and abandoned*
		St. Boniface Chapel	9/13/56	5,791,938	56,266	5,848,204	Producing
	Murrysville	*TOTAL*	*11/ 3/1878*	*709,092*	*20,905*	*729,997*	*Producing and abandoned*
		Duquesne	8/ 8/65	580,975	20,905	601,880	Producing
Westmoreland and Somerset.	Johnstown	*TOTAL*	*5/16/57*	*28,554,366*	*624,873*	*29,179,239*	*Producing and abandoned*
		Baldwin Beck	5/22/60 5/16/57	10,459,533	18,401 339,342	10,817,276	Producing and abandoned
		Williams	2/14/58	18,094,833	267,130	18,361,963	Producing
	Seven Springs	*TOTAL*	*12/15/58*	*7,563,382*	*142,179*	*7,705,561*	*Producing and abandoned*
		Blair Tunnel	12/ 5/58 3/10/65	6,162,764	98,916 22,975	6,284,655	Producing Producing
		Seven Springs	8/ 3/66	688,195	20,288	708,483	Producing

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* Mcf = thousand cubic feet

** Correction

aged $109.49 per acre. In September 1978, 19,711 acres was leased and the bonus bid for this acreage averaged $18.81 per acre. This was a total for the year of 42,367 acres leased for $2,851,369.

At the end of the year, 251,748 acres of State Forest and Park lands was currently under lease for oil and gas exploration and development. This includes 100,206 acres in gas storage areas.

1978 OIL AND GAS EXPLORATORY AND DEVELOPMENT HIGHLIGHTS

These classifications comprise the same wells reported under drilling and completions.

EXPLORATORY WELLS

An exploratory well is a well drilled to (1) find and produce oil or gas in an unproved area; (2) find a new reservoir in a field previously found to be productive of oil or gas in another reservoir; or (3) extend the limits of a known oil or gas reservoir. Exploratory wells include the following: new field wildcat, new pool wildcat, deeper pool test, shallower pool test, or outpost extension test. If the well is not completed for production, it is an exploratory dry hole. Exploratory drilling in 1978 (97 wells) was up 4 percent from 1977 (93 wells), and had a 78 percent success ratio (see Figure 22 for location of oil and gas fields, and Figure 20 for locations of all exploratory wells drilled in 1978).

DEVELOPMENT WELLS

In general, a development well is a well drilled within the proved area of an oil or gas reservoir to the depth of a stratigraphic horizon known to be productive. If the well is completed for production, it is classified as an oil or gas development well. If the well is not completed for production, it is classified as a dry development hole. Development drilling in 1978 was up 20 percent from 1977, and had a 98 percent success ratio.

Figure 21 shows both exploratory and development drilling for 1978 by type of well (oil, gas, etc.) and gives total footage.

Explanations for an exploratory and development well are modified from definitions used by the Committee on Statistics of Drilling of the American Petroleum Institute/American Association of Petroleum Geologists.

HIGHLIGHTS OF 1978 EXPLORATION

Amoco Production Company and U.G.I. Development Corporation began an extensive exploratory drilling program in Pennsylvania in May 1977. This program continued through 1978 and resulted in two new field discov-

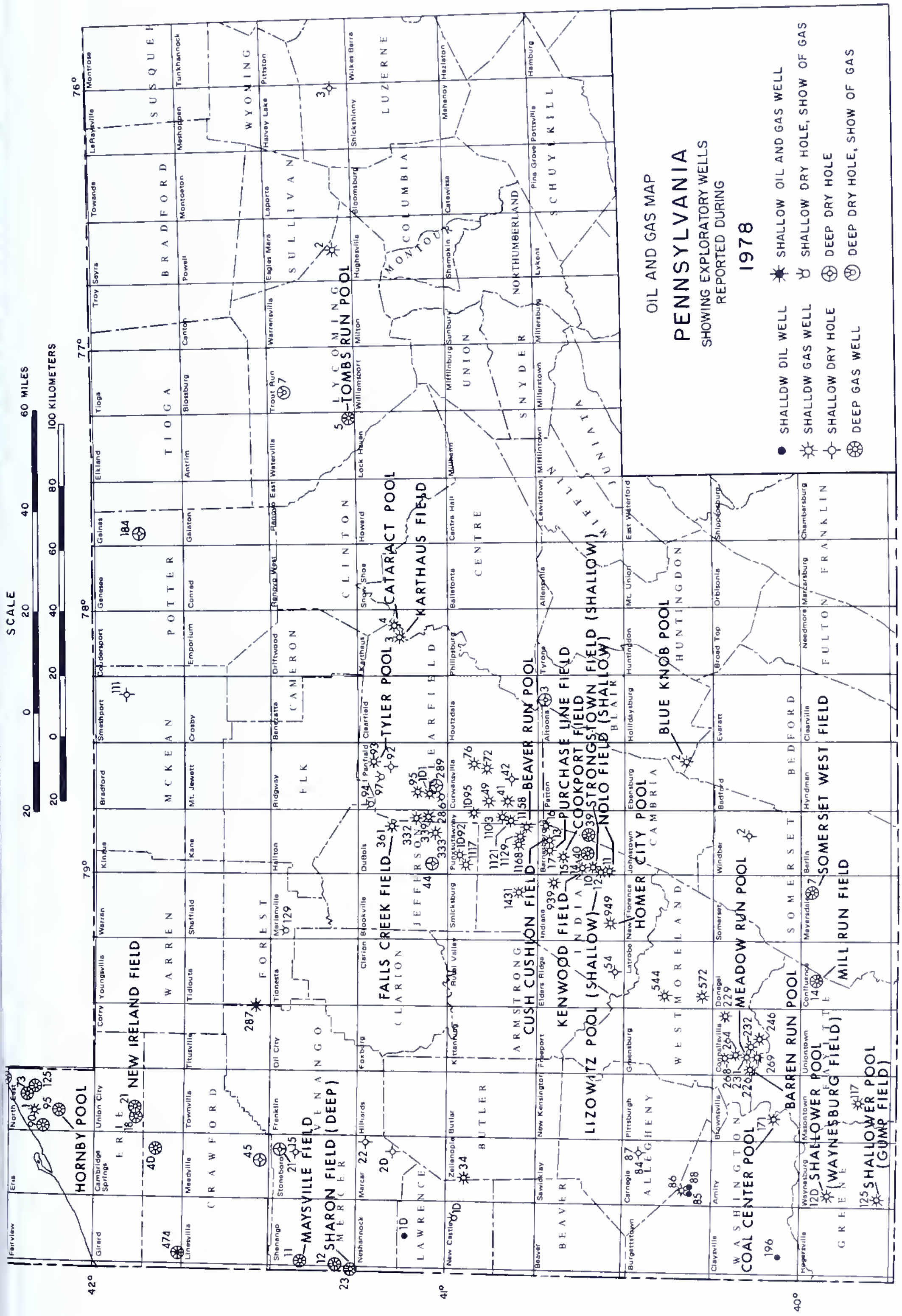


Figure 20. Map of exploratory wells in Pennsylvania reported in 1978

Figure 21. Exploratory and primary development and drilling footages reported, 1977 and 1978

Type of well	*1978 Wells*	*1978 Footage*	*1977 Wells*	*1977 Footage*	*% Change in footage*
Exploratory					
Gas	70	282,452	47	172,894	
Oil	4	8,933	1	1,604	
Oil and gas	2	5,698	1	1,964	
Dry	21	81,403	44	172,464	
Total (% successful)	*97 (78%)*	*378,486*	*93 (53%)*	*348,926*	*+ 8*
Development					
Gas	1,035	3,512,059	647	2,311,367	
Oil	553	570,847	677	715,361	
Oil and gas	13	27,293	9	25,498	
Dry	29	67,357	28	51,164	
Total (% successful)	*1,630 (98%)*	*4,177,556*	*1,361 (98%)*	*3,103,390*	*+ 35*
Miscellaneous wells					
Service and stratigraphic	21	25,675	8	9,489	*+ 171*
TOTAL ALL WELLS DRILLED	*1,748 (97%)*	*4,581,717*	*1,462 (95%)*	*3,461,805*	*+ 32*

eries during the year. The Amoco/U.G.I. #1 Engleka opened the Somerset West field in Somerset County and their #1 Maude Mountain well discovered the Mill Run field in Fayette County (see Figures 20 and 23 for more detail).

The most significant well in the Amoco and U.G.I. program and in Pennsylvania in the last few years was drilled in 1977 but has remained an incomplete tight hole through 1978. This well is the Amoco/U.G.I. #1 Texasgulf well, located 8 miles northwest of Bellefonte, Snow Shoe quadrangle, Boggs Township, Centre County. The well is reported to have had a visually estimated flow of 20 to 37 million cubic feet of gas per day from the Lower Silurian Tuscarora sandstone at 10,760 feet. A confirmation well, Amoco/U.G.I. #2 Texasgulf, located one-half mile to the southwest, was completed in 1978 as a dry hole. A third well, Amoco #1 C & K Coal, located one and one-half miles northwest of the #1 Texasgulf discovery, is drilling, and a fourth well by Amoco has been located. As a result of interest in these wells, the Commonwealth of Pennsylvania in 1978 leased 42,367 acres of State Forest lands in the vicinity for a total of $2,851,369.

Medina (Lower Silurian) sandstone gas development in northwestern Pennsylvania continued during the year at a rapid pace. A total of 110 new gas wells and one oil and gas combination well was completed in Erie County in the Medina Group sandstones. One new field, New Ireland, and one new pool, Hornby, were discovered. Two additional Medina discoveries were made in Mercer County, Maysville field, and a deeper pool discovery in the Sharon field (see Figures 20 and 23 for more detail).

Research funded by the Department of Energy concerning Devonian black shales and their natural-gas potential continued into 1978. Work accomplished by the Pennsylvania Geological Survey and cooperative test wells involving the Department of Energy and private companies are discussed in the following section, "Devonian Shale Research in Pennsylvania — An Update."

Figures 20, 23, and 24 include a map showing the 1978 exploratory effort, a table showing all 1978 new field and new pool discoveries, and a table showing selected exploratory failures.

PROJECTS IN PROGRESS IN 1978, OIL AND GAS GEOLOGY DIVISION, BUREAU OF TOPOGRAPHIC AND GEOLOGIC SURVEY

OIL AND GAS BASE MAP PROGRAM

Twenty-six base maps showing locations of oil and gas wells and the outlines of oil, gas, and gas storage fields are available (see Figure 25 for an

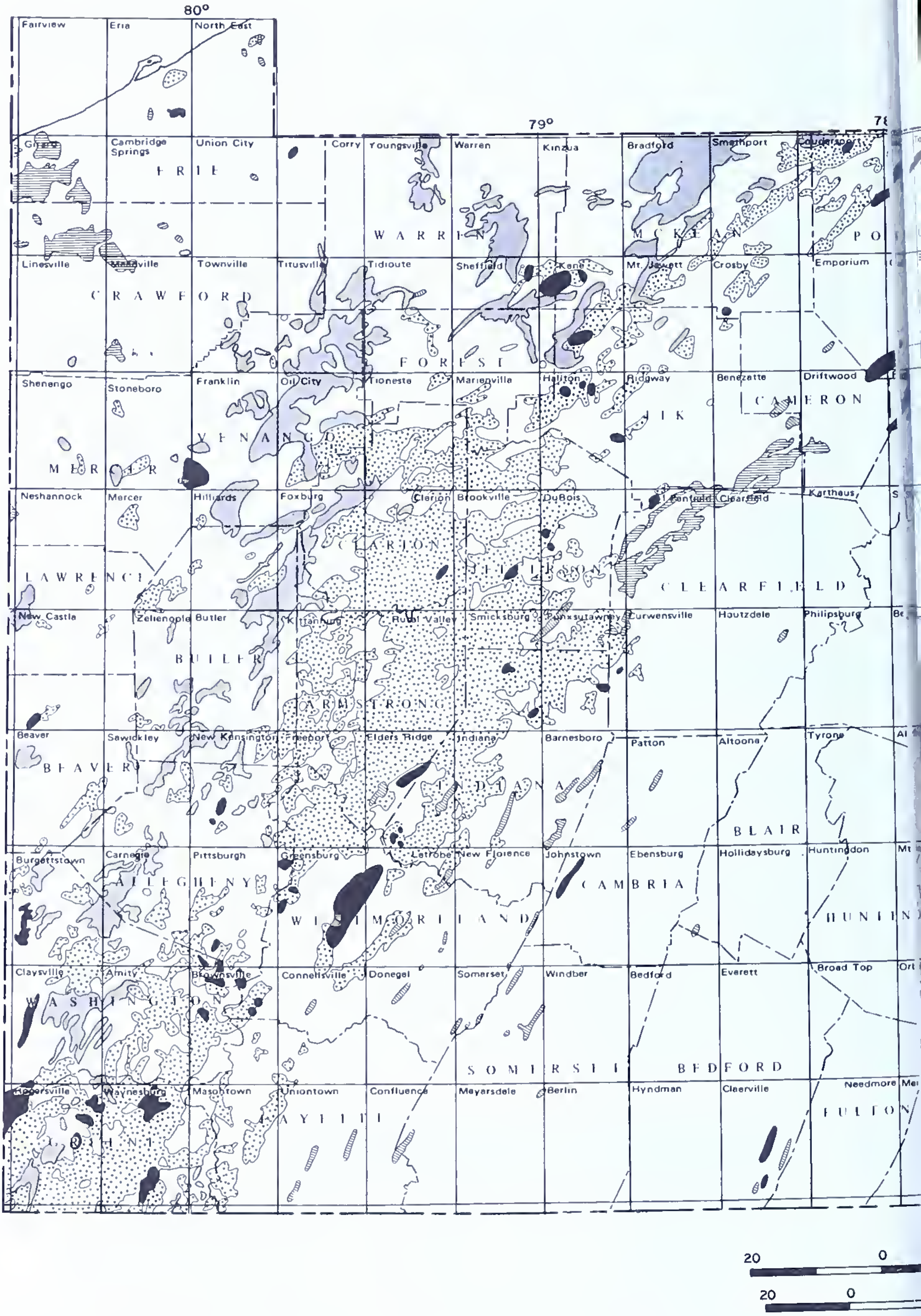
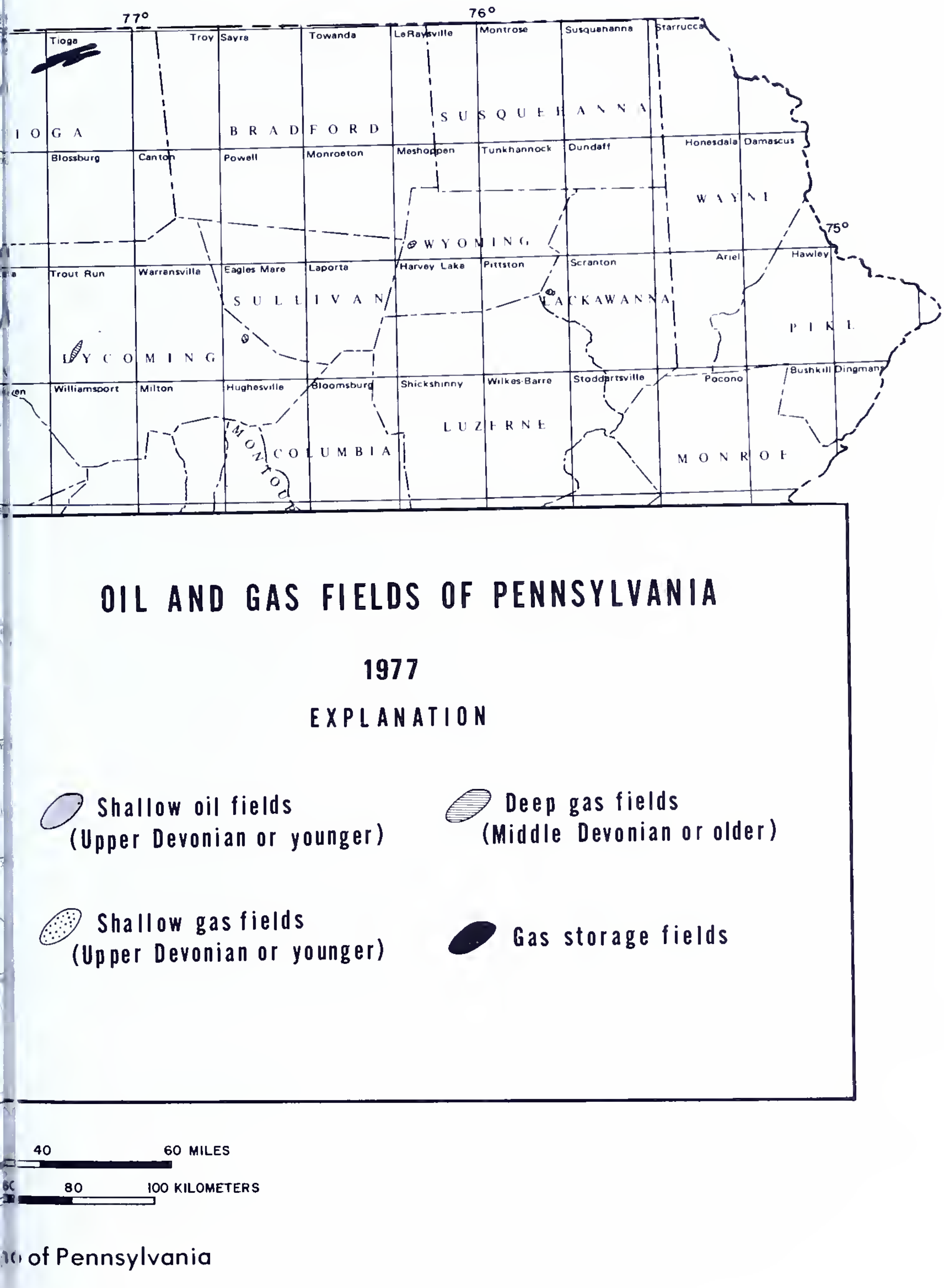


Figure 22. Oil a



OIL AND GAS FIELDS OF PENNSYLVANIA

1977

EXPLANATION

Shallow oil fields (Upper Devonian or younger)
Deep gas fields (Middle Devonian or older)
Shallow gas fields (Upper Devonian or younger)
Gas storage fields
40
60 MILES
80
100 KILOMETERS
of Pennsylvania

Figure 23. Reported new field and new pool discoveries in Pennsylvania, 1978

County and permit no.	Quadrangle and map no.	Operator well no. and lease	Compl. date (M-Day-Y)	Total depth (feet)	Name of formation at T.D.*	Prod. depth (feet)	Prod. formation or zone*	Initial daily prod.	Field or pool name	Explor. class***
Blair BLA-20009	Ebensburg 2	Adobe Oil and Gas Corp. Clair and Thelma Stombaugh #1	6/22/78	3,517	Canadaway (D)	2,914	Balltown (D)	49 Mcf	Blue Knob pool	SPD
Clearfield CLE-20615	Karthaus 3	Consolidated Gas Supply James E. Hoffman #1	10/31/76	5,040	Canadaway (D)	4,706	Canadaway (D)	84 Mcf	Karthaus field	NFD
Clearfield CLE-20751	Karthaus 4	Consolidated Gas Supply Leitzinger Bros. Realty #1	8/11/78	4,702	Canadaway (D)	4,256	Canadaway (D)	119 Mcf	Cataract pool	NPD
Clearfield CLE-20662	Penfield 93	Consolidated Gas Supply Antonio J. Palumbo #1	11/13/77	3,428	Canadaway (D)	2,982	Bradford First (D)	158 Mcf	Tyler pool	SPD
Clearfield CLE-20709	Punxsutawney 1158	Consolidated Gas Supply J. L. Brothers Est. #1	8/20/78	5,028	Canadaway (D)	4,241	Canadaway (D)	335 Mcf	Beaver Run pool	NPD
Erie ERI-20505	North East 95	Envirogas, Inc. Thomas Fritts #1	7/10/78	3,667	Queenston (O)	3,575	Whirlpool (S)	43 Mcf	Hornby pool	NPD
Erie ERI-20530	Union City 21	Northwest Natural Gas Co. Earl H. and Helen W. Jant #1	5/14/78	4,202	Queenston (O)	4,150	Whirlpool (S)	2,200 Mcf	New Ireland field	NFD
Fayette FAY-20200	Confluence 14	Amoco Production and U.G.I. Maude Mountain #1	8/17/78	8,150	Helderberg (D)	7,946	Oriskany (D)	500 Mcf	Mill Run field	NFD
Greene GRE-21356	Waynesburg 120	Emerald Mines Corp. Perry E. Lemley #EM-6	2/12/76	616	Conemaugh (P)	586	Pittsburgh Coal (P)	7 Mcf	Waynesburg field	SPD
Greene GRE-21316	Waynesburg 125	Carnegie Natural Gas Co. R. E. Lemley et ux #2	12/ 2/75	828	Conemaugh (P)	760	Pittsburgh Coal (P)	8 Mcf	Gump field	SPD
Indiana IND-23941	Barnesboro 10	Felmont Oil Corp. Charles Lisowitz Estate #2	2/ 2/78	3,855	Canadaway (D)	3,458	Canadaway (D)	65 Mcf	Strongstown shallow field	SPD
Indiana IND-23991	Barnesboro 11	Felmont Oil Corp. J. H. Graham #1	3/23/78	3,768	Canadaway (D)	3,639	Canadaway (D)	100 Mcf	Nolo shallow field	SPD
Indiana IND-24115	Barnesboro 12	Felmont Oil Corp. Fenella Hatch Estate #2	3/23/78	3,699	Canadaway (D)	3,544	Canadaway (D)	240 Mcf	Lizowitz shallow pool	SPD
Indiana IND-24276	Barnesboro 13	Consolidated Gas Supply Rhuel Stiffler WN-1679	8/28/78	3,916	Canadaway (D)	3,766	Kane (D)	411 Mcf	Cush Cushion field	NFD
Indiana IND-24439	Barnesboro 14	Consolidated Gas Supply Iral I. Savage #1	10/10/78	3,667	Canadaway (D)	3,456	Bradford Stage (D)	103 Mcf	Kenwood field	NFD
Indiana IND-24434	Barnesboro 15	Watson and Swanson, Inc. Nesbit Shaffer #1	10/ 7/78	3,827	Canadaway (D)	3,708	Bradford Stage (D)	531 Mcf	Cookport field	NFD
Indiana IND-24453	Barnesboro 17	Watson and Swanson, Inc. Genevieve Lockard #2	10/12/78	3,970	Canadaway (D)	3,915	Kane (D)	1,061 Mcf	Purchase Line field	NFD

Indiana IND-24218	Indiana 949	Doran and Associates, Inc. J. Herman Neal #1	6/15/78	3,928	Canadaway (D)	3,694	Bradford Stage (D)	1,342 Mcf	Homer City pool	NPD
Jefferson JEF-21620	DuBois 361	Consolidated Gas Supply Magdalene M. Senior #1	7/24/78	3,228	Canadaway (D)	2,996	Bradford Stage (D)	198 Mcf	Falls Creek field	NFD
Lawrence LAW-20020	Neshannock 10	Lewis Dewberry Dewberry #1	5/23/77	246	Pottsville (P)	205	Pottsville (P)	1 bbl	Unnamed	NFD
Lycoming LYC-20017	Eagles Mere 2	UGI Development Co. Donald L. Fulmer #1	7/ 2/77	2,311	Catskill (D)	1,098	Catskill (D)	15 Mcf	Unnamed**	NFD
Lycoming LYC-20025	Waterville 5	John H. Ware Robert Sulik #1	5/26/78	7,245	Helderberg (D)	7,192	Huntersville Chert (D)	40 Mcf	Tombs Run pool	NPD
Mercer MER-20147	Kinsman 23	Cyclops Corporation Michael Vranich #1	2/26/77	5,045	Queenston (O)	4,932	Medina (S)	1,666 Mcf	Sharon deep pool	DPD
Mercer MER-20131	Shenango 11	Energy Services Bruce and Bertha Metzger #1	11/11/77	4,912	Medina (S)	4,862	Medina (S)	500 Mcf	Maysville field	NFD
Somerset SOM-20061	Meyersdale 7	Amoco Production and U.G.I. Simon G. Engleka, Jr. #1	10/13/77	9,201	Keyser (D-S)	9,014	Ridgeley (D)	4,100 Mcf	Somerset West field	NFD
Washington WAS-21145	Brownsville 171	Peoples Natural Gas Co. Cora Evelyn Ailes #1	10/14/78	1,870	Big Injun (M)	1,700	Big Injun (M)	3,970 Mcf	Coal Center pool	NPD
Washington WAS-21118	Carnegie 86	August Petroleum Corp. Irk McConnell et ux #2	3/ 8/78	1,693	Big Injun (M)	1,693	Big Injun (M)	4,200 Mcf	Canonsburg field	SPD
Westmoreland WES-21158	Connellsville 226	Snee, Eberly and Peoples Sarah Shirey et al. #1	3/30/78	4,026	Canadaway (D)	3,365	Canadaway (D)	86 Mcf	Barren Run pool	NPD
Westmoreland WES-21214	Connellsville 231	Louden Properties Russell L. Byers #842-1	4/19/78	3,796	Canadaway (D)	3,457	Bradford First (D)	330 Mcf	Meadow Run pool	NPD

* (P) = Pennsylvanian; (M) = Mississippian; (D) = Devonian; (S) = Silurian; (D-S) = Devonian-Silurian; (O) = Ordovician

** Noncommercial well

*** NFD = new field discovery; NPD = new pool discovery; DPD = deeper pool discovery; SPD = shallower pool discovery

Figure 24. Selected exploratory failures reported in Pennsylvania, 1978

County and permit no.	*Quadrangle and map no.*	*Operator well no. and lease*	*Compl. date (M-Day-Y)*	*Total depth (feet)*	*Name of formation at T.D.**	*Explor. class***
Allegheny ALL-20959	Carnegie 87	Town Development, Inc. Paul Kossman #2-A	5/ 1/78	4,373	Canadaway (D)	NFW
Blair BLA-20010	Altoona 3	Texaco, Inc. Blair Gap Supply Co. #1	3/ 3/78	7,145	Helderberg (D)	NFW
Cambria CBA-20078	Barnesboro 39	Consolidated Gas Supply W. D. Wilson #WN-1653	9/17/78	8,304	Mahantango (D)	DPT
Clearfield CLE-20680	Curwensville 42	Consolidated Gas Supply Helen T. McGee #1	12/10/77	4,951	Canadaway (D)	NFW
Luzerne LUZ-20008	Harveys Lake 3	PA Energy Resources Penn Gas Development #1	12/13/77	2,825	Catskill (D)	NFW
Indiana IND-24201	Elders Ridge 54	Peoples Natural Gas Co. Lewis Dudash #2	7/29/78	7,870	Helderberg (D)	DPT
Mercer MER-20162	Stoneboro 21	Pennzoil Company Sheehan #1	5/ 5/78	5,402	Queenston (O)	DPT

* (D) = Devonian; (O) = Ordovician

** NFW = new field wildcat; DPT = deeper pool test

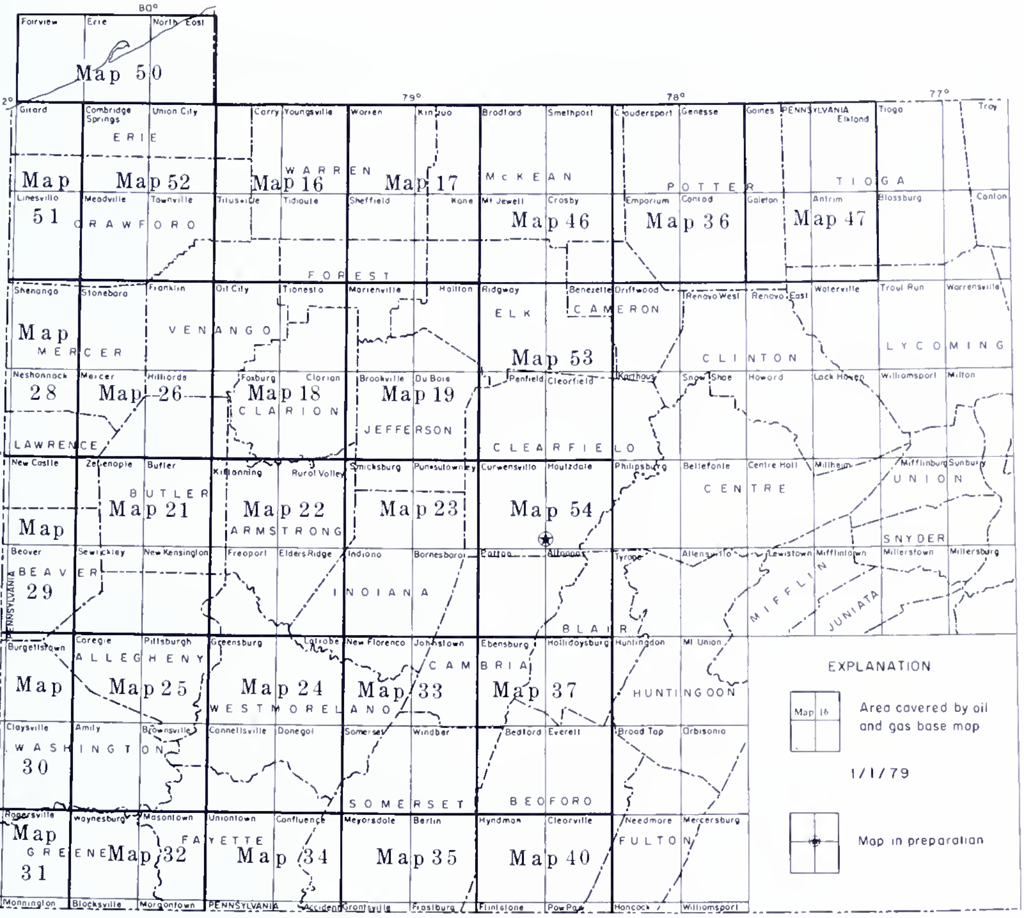


Figure 25. Index of oil and gas well base maps

index map of the area covered). Each base map encompasses four 15-minute topographic quadrangles at a scale of 1:62,500, or 1 inch equals approximately 1 mile. A 5-minute grid, quadrangle names, county boundaries, and major rivers and towns make up the background of the base map. All known deep wells (wells that penetrated Middle Devonian or older rocks) and those shallow wells (wells not reaching Middle Devonian) on record with the Survey are located. Status (dry, oil, gas, etc.) of each, and elevation and total depth of many, are shown. Symbols indicate whether borehole geophysical log and sample data are on file in the Survey's Oil and Gas Geology Division office in Pittsburgh. An index map near the legend shows the outlines of oil, gas, and gas storage fields within the mapped area, thus indicating the extent of areas of pre-1956 drilling. A list of field names is also included. All maps were updated in 1978.

Paper prints of the base maps can be obtained by writing to the State Book Store, P. O. Box 1365, Harrisburg, Pennsylvania 17125. The cost of each base map is $0.50, plus a 6 percent sales tax to Pennsylvania residents. A check for the appropriate total amount, made payable to the "Commonwealth of Pennsylvania," must accompany the order. When ordering, please specify the map number.

A cross index of state permit numbers with quadrangle map numbers used on the base maps is available from the Oil and Gas Geology Division of the Pennsylvania Geological Survey, 1201 Kossman Building, 100 Forbes Avenue, Pittsburgh, Pennsylvania 15222. This index is arranged by quadrangles. Please specify the quadrangle when requesting this literature.

DEVONIAN SHALE RESEARCH IN PENNSYLVANIA — AN UPDATE

by John A. Harper and Kathleen D. Abel

The Pennsylvania Geological Survey, Oil and Gas Geology Division, has been under contract to the U.S. Department of Energy (DOE) since 1976 to aid in an evaluation of the hydrocarbon resource potential of the Middle and Upper Devonian organic-rich shales in the subsurface of Pennsylvania. A general summary of the Eastern Gas Shales Project and the Survey's expected part in it was published by Piotrowski and Krajewski (1977). The initial, regional phase of this project has been completed and a second, detailed phase has begun.

The Survey's task was to provide a resource evaluation of the Devonian shale. This entailed essentially two objectives: (1) relating the shales to the known stratigraphic record in Pennsylvania, and (2) detailing the production capabilities of the shales. The initial phase was a regional study of the Devonian organic-rich shales. During the past two years, numerous maps, cross sections, and reports were completed and sent to DOE for publication by its Morgantown Energy Technology Center (METC) in Morgantown, West Virginia. These items are presently on open file at the University of Kentucky, the Ohio Geological Survey, the Illinois State Geological Survey, and at METC, as well as at the Pennsylvania Geological Survey, Oil and Gas Geology Division. A list of these items is provided at the end of this discussion.

The first objective of the Eastern Gas Shales Project in Pennsylvania was to provide a stratigraphic and structural framework for the Middle and Upper Devonian rocks in the subsurface and to map the distribution, thickness, and lithologic relationships of the organic-rich shales to adjacent strata. Figure 26 demonstrates the facies relationships of the organic-rich shales to nonorganic shales and siltstones and the Upper Devonian shallow-sand oil and gas reservoirs. Most of the terminology for the organic-rich shale facies and associated rocks is derived from that of the New York

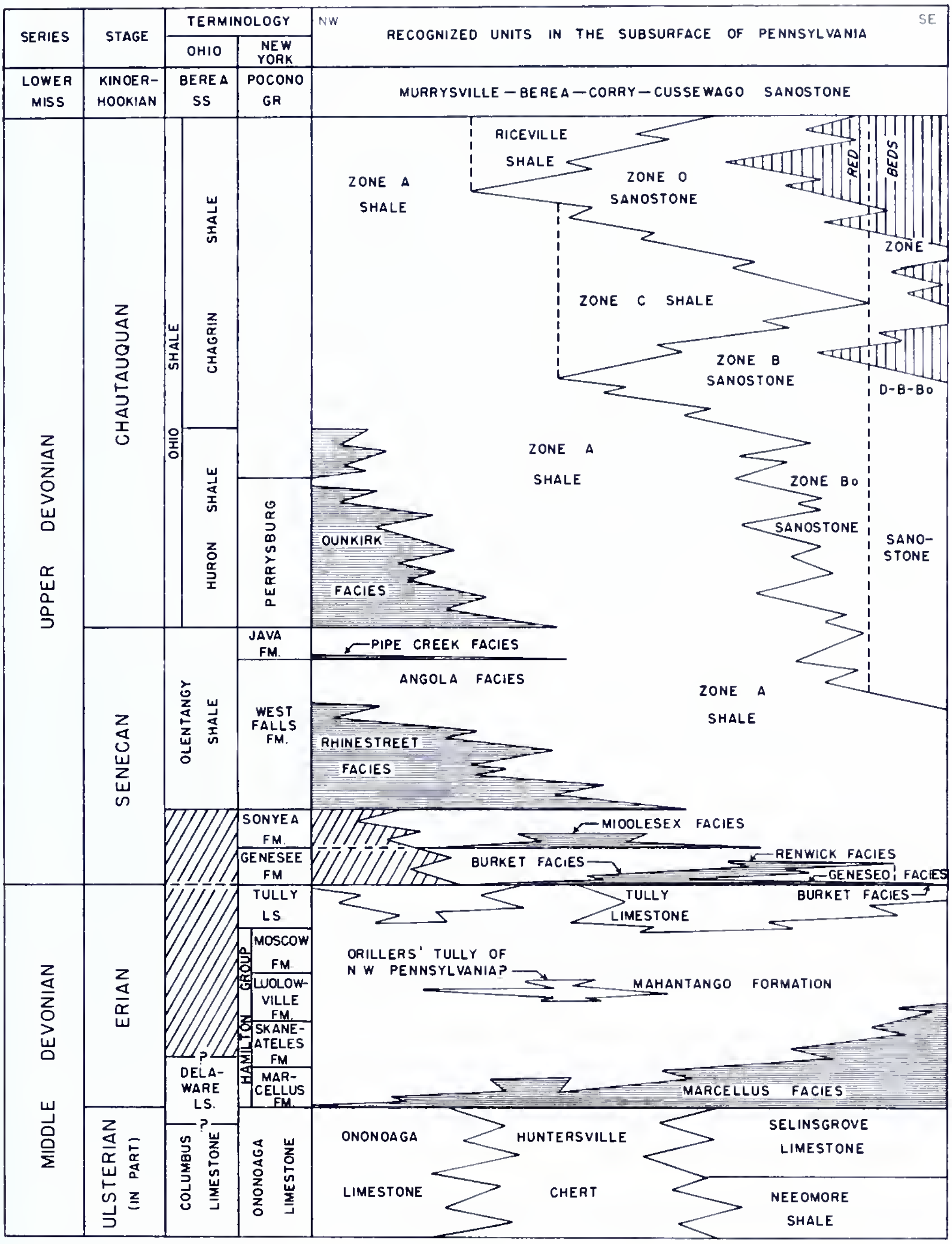


Figure 26. Schematic illustration of Upper and Middle Devonian stratigraphic units in the subsurface of Pennsylvania

Geological Survey (Rickard, 1975) modified by the U.S. Geological Survey (Oliver and others, 1969). Two Pennsylvania names, Mahantango Formation and Burket Shale, have been retained in place of New York nomenclature.

Devonian shale studies show that three major and three minor organic-rich shale facies are recognizable in the subsurface of Pennsylvania. These facies are delineated in the subsurface by gamma-ray logs, which are sensitive to the higher degree of radioactivity emitted by organic-rich shales than by normal shales. Discussion of the empirical evidence of using gamma-ray logs to detect potential gas-producing shales is found in Piotrowski and Krajewski (1977) and in Harper and Piotrowski (1978). The three major organic-rich shale facies include the Middle Devonian Marcellus facies of the Hamilton Group, the Upper Devonian Rhinestreet facies of the West Falls Formation, and the Upper Devonian Dunkirk facies of the "Perrysburg Formation." The minor units, the Burket-Geneseo-Renwick facies of the Genesee Formation, the Middlesex facies of the Sonyea Formation, and the Pipe Creek facies of the Java Formation, are all Upper Devonian. Each of these organic-rich shale facies represents the base of an upward- and eastward coarsening sequence of clastic sediments deposited in cyclical fashion in the Devonian seas.

Maps and cross sections of these facies and their associated strata indicate the following:

(1) The Marcellus facies is the most widespread of the Devonian organic-rich shales in Pennsylvania, and it is the greatest accumulation, in terms of net feet, of organic-rich shale. The Marcellus forms the basal unit of the Hamilton Group, and, at its maximum accumulation (greater than 225 net feet of organic-rich shale in Bradford County), is equivalent to the Marcellus, Skaneateles, and basal Ludlowville Formations of New York. The Marcellus facies is overlain by, and intercalated with, the nonorganic and often coarser clastics of the Mahantango Formation.

(2) The Tully Limestone overlies the Mahantango Formation and forms the top of the Middle Devonian. Previous reports (e.g., Piotrowski and Krajewski, 1977) indicated that the Tully was apparently truncated by an unconformity in northeastern Pennsylvania, as proposed by New York workers (Wright, 1973; and others). In the light of present studies, however, the presence of this truncation is questionable. The thick accumulation of carbonates in Erie and Crawford Counties that were considered to be equivalent to certain Hamilton Group limestones have been directly correlated, without interruption, to the outcrop of Tully Limestone in central Pennsylvania (Louis Heyman, unpublished cross section, 1978). We do not recognize unconformities in the Tully section of Pennsylvania. Areas where the carbonates are absent (Warren and McKean Counties, Lawrence and Mercer Counties, and Somerset and Cambria Counties) are better explained as the result of facies changes rather than of erosion.

(3) The Burket-Geneseo-Renwick facies, the basal unit of the Genesee Formation, lies directly above the Tully Limestone (or its Hamilton equivalent) over most of the area studied. In the northeastern portion of this area

the Burket is split by a series of interbedded nonorganic clastics into an upper, Renwick facies and a lower, Geneseo facies. Both Geneseo and Renwick are recognized members of the Genesee Formation of New York. The combined facies reaches its maximum development (50 to 75 net feet of organic-rich shale) in the north-central part of the state. The entire Genesee Formation is absent in extreme northwestern Pennsylvania. We are not certain if this is the result of erosion or of the Genesee onlapping the Tully Limestone, although we suspect the latter.

(4) The Middlesex facies, the basal unit of the Sonyea Formation, was originally called the "first marker" by Piotrowski and Krajewski (1977). The facies may attain a total unit thickness of over 100 feet of interbedded organic-rich shale, nonorganic shale, and siltstone in some areas, but only in eastern McKean and western Potter Counties does it attain a facies thickness of greater than 25 net feet of organic-rich shale. The facies quickly becomes intercalated with other clastics and loses its lithologic identity along a generally northeast/southwest-striking line from Fayette County to Potter County. In northwestern Pennsylvania, the Sonyea is absent, apparently for the same reason that the subjacent Genesee Formation is absent (i.e., onlap or erosion).

(5) The Rhinestreet facies, called "Zone I facies" by Piotrowski and Krajewski (1977), is the lower of two facies in the West Falls Formation. The upper unit is a combination of shales and siltstones which, for the sake of simplicity, have been conveniently lumped together and referred to as the Angola shale facies. The Rhinestreet is identifiable to about the center of the Plateau area, where it becomes diluted with nonorganic clastics and disappears. It reaches its maximum development (greater than 200 net feet of organic-rich shale) in a broad belt extending from Beaver and Lawrence Counties to Warren and Erie Counties. In northwestern Pennsylvania, where the Genesee and Sonyea Formations are absent, the Rhinestreet is directly superjacent to the Tully Limestone.

(6) The Pipe Creek facies is the basal unit of the Java Formation. It is the facies referred to by Piotrowski and Krajewski (1977) as the "second marker." The Pipe Creek is a minor but very persistent organic-rich marker, readily recognizable on a gamma-ray log. It never exceeds 20 net feet of organic-rich shale in Pennsylvania and quickly disappears southeast of a line from Washington to McKean Counties.

(7) The Dunkirk facies, called "Zone II facies" by Piotrowski and Krajewski (1977), is the basal portion of the "Perrysburg Formation." It is a thick facies, equivalent to the Huron Shale of Ohio, but it has the most restricted distribution of any organic-rich shale in Pennsylvania. The "Perrysburg Formation" is questionable as a stratigraphic unit in Pennsylvania because the upper boundary is not well established in the subsurface. We feel the name "Perrysburg" is ultimately more realistic than the name

"Canadaway," however, and use it with the understanding that more work needs to be done in order to establish whether "Perrysburg" is valid in the subsurface nomenclature of Pennsylvania.

The second objective of the Survey's part in the Eastern Gas Shales Project was to provide production data on wells penetrating the shales and to examine the capabilities of the shales as potential gas reservoirs. The production of natural gas from these shales has been limited in Pennsylvania since the 1940's. Prior to that time the Upper Devonian shales were a major target for exploration in Erie County, where gas was readily available at shallow depths. For instance, in 1928 Frank Warner of Cranesville drilled a water well on his property to a depth of 36 feet, in which he encountered enough gas in the shale to provide an adequate private supply. Most of the wells drilled in these shallow shales had low pressures and small open-flow rates, but they could be relied upon for their long life spans and as such were ideal for domestic use. We have received many reports of old wells in and around the city of Erie that still provide sufficient quantities of gas to the owners. Although production details of most shale-gas wells drilled prior to 1960 are sketchy, some data are available on 20 wells drilled into the shale in the Girard field (Figure 27) in 1941 by the Ohio Oil Company (now Marathon Oil Company). These wells had open-flow rates ranging from a low of 116,000 cubic feet of gas per day to a high of 4,168,000 cubic feet of gas per day, all from depths of less than 800 feet. There is no record of gas produced from shales in Pennsylvania between 1941 and 1961, but since 1961 fourteen wells were reported to have produced, or had significant production potential, from the Upper Devonian shales. These wells are shown in Figures 27 and 28.

In 1961 the Carter #1 well was drilled as a test of the Medina in Crawford County. The well was completed as a dry hole, but a small show of gas from the Upper Devonian shale at a depth of 95 feet was deemed adequate for a domestic supply. The Matczak #1 well, drilled in 1964 in Erie County, had an initial open-flow potential of 15,000 cubic feet of gas per day from a zone 350 feet thick in the shale. The remaining 12 wells (Figure 28) were drilled since 1975. Several of these more recent wells have interesting histories. The Metropolitan Industry #1 well (Figure 27), originally drilled as a test of the Medina, was plugged back to test the Rhinestreet shale facies (Figure 26). There was a small but significant show from this facies, and after fracture an initial potential of 150,000 cubic feet of gas per day was gauged. Unfortunately, the well blew down quickly and afterward would not hold a sustained flow. Piotrowski (1978) postulated that there was little natural porosity in the shale and that the gas had accumulated in fractures induced by stimulation. The fractures apparently were not extensive enough to constitute an adequate reservoir for commercial production of gas, and the well was eventually plugged and abandoned.

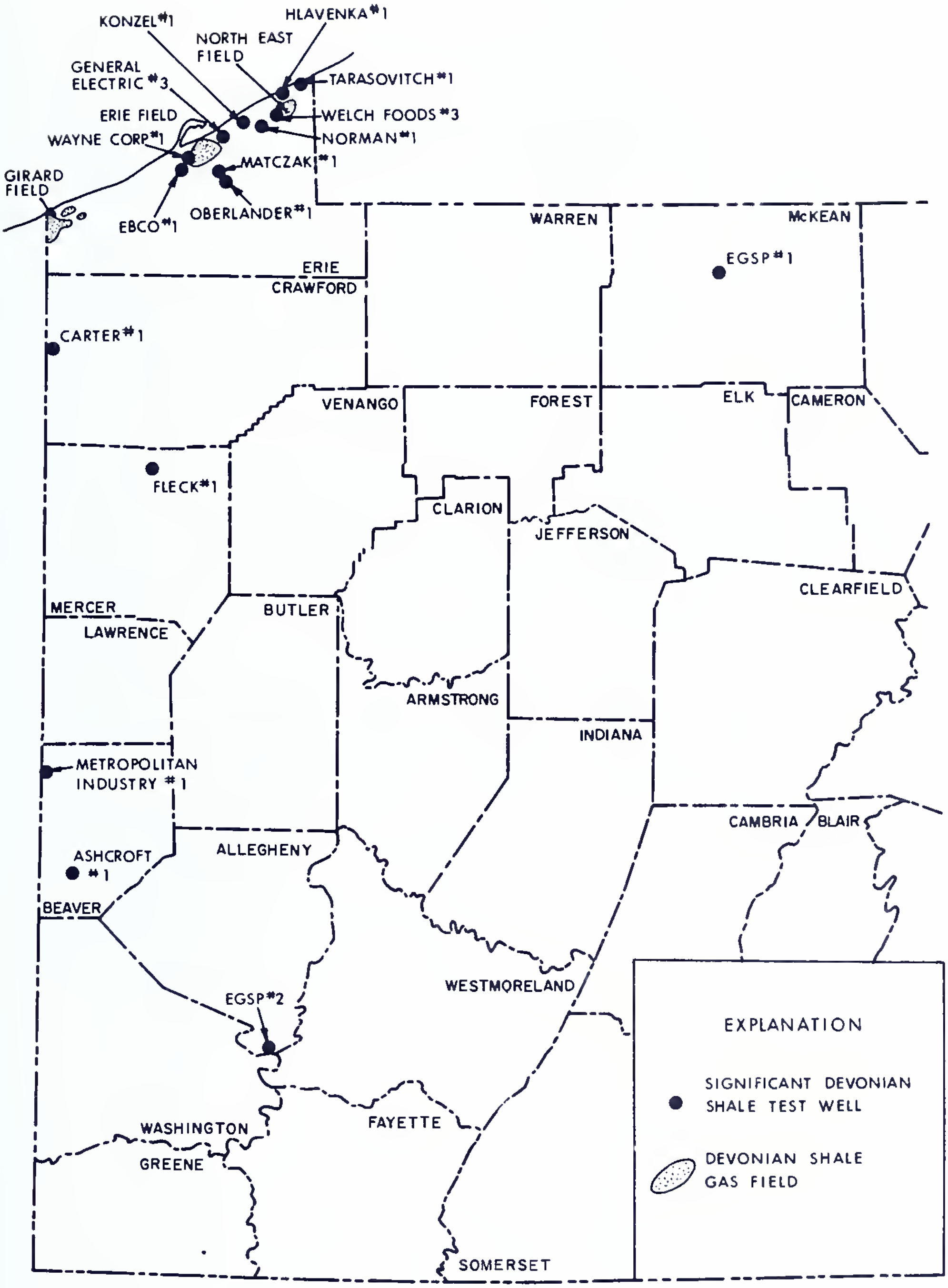


Figure 27. Location of significant shale-gas wells and fields in Pennsylvania

In 1977, the EBCO #1 well (Figure 27) was completed in Erie County at a depth of 901 feet in the Dunkirk Shale facies (Figure 26). The well encountered gas shows from three horizons, and each show was initially gauged at over 1,000,000 cubic feet of gas per day. After the well was shut in for five

Figure 28. Reported shale gas wells drilled in Pennsylvania after 1960

County	*Operator well no. and lease*	*Compl. date (M-Day-Y)*	*Original target*	*Initial potential*	*Rock pressure (lbs.)*	*Producing shale facies*
Crawford	J. Sterling McCluskey 1 Carter	6/16/61	Medina	Unknown*	Unknown	Dunkirk
Erie	Leon Matczak 1 Leon Matczak	8/28/64	Upper Devonian	15 Mcfgpd	22	Dunkirk
Beaver	Quaker State 1 Metropolitan Industry	2/ 6/75	Medina	150 Mcfgpd**	1150	Rhinestreet
Erie	Frank W. Norman 1 Frank W. Norman	4/ 1/75	Upper Devonian	20 Mcfgpd	22	Dunkirk
Beaver	St. Joe Petroleum 1 Ashcroft	2/19/76	Medina	40 Mcfgpd	1560	Rhinestreet
Erie	Nicholas Konzel 1 Nicholas Konzel	5/ 6/76	Upper Devonian	5 Mcfgpd	30	Dunkirk
Erie	Welch Foods 3 Welch Foods	9/30/76	Medina	150 Mcfgpd	80	Dunkirk
Erie	Henry Oberlander 1 Henry Oberlander	4/ 8/77	Upper Devonian	4 Mcfgpd	32	Dunkirk
Erie	Michael Tarasovitch 1 Michael Tarasovitch	9/ 3/77	Upper Devonian	3 Mcfgpd	36	Dunkirk
Erie	Moody and Associates 1 EBCO	11/ 3/77	Upper Devonian	975 Mcfgpd	100	Dunkirk
Erie	General Electric 3 General Electric	11/ 6/77	Medina	30 Mcfgpd	20	Dunkirk
Mercer	Peoples Natural Gas 1 Fleck	3/16/78	Medina	Unknown***	Unknown	Rhinestreet
Erie	John Hlavenka 1 John Hlavenka	4/10/78	Upper Devonian	0.7 Mcfgpd	35	Dunkirk
Erie	Wayne Corporation 1 Wayne Corporation	5/ 8/78	Medina	363 Mcfgpd	57	Dunkirk

* Exact figure unknown; enough for domestic use.

days, a sustained natural open flow of 975,000 cubic feet of gas per day was gauged. Sibilation logs run in nearby wells indicate a system of natural fractures in the rock which is apparently extensive enough to serve as a gas reservoir in the area adjacent to Lake Erie. Mineralogical analysis of rock from the three producing horizons in the EBCO well indicates that the shale contains significant amounts of an expandable mixed-layer clay, which could cause considerable problems of hole collapse if freshwater-based stimulation is employed (Harper and Piotrowski, 1978). We feel that mineralogical analyses of the shales should be made prior to any fracturing in future shale-gas well operations.

In March 1978, DOE attempted to stimulate the Rhinestreet facies in the Fleck #1 well in Mercer County (Figure 27). The well had originally been drilled as a test of the Medina, and although a significant amount of gas was encountered, it was not deemed sufficient to justify the expense of putting the well on line. DOE proposed to stimulate the Rhinestreet facies by means of a massive hydraulic fracturing treatment. However, the casing in the well failed during treatment and the well had to be plugged and abandoned.

The Marcellus is the only one of the three major organic-rich shale facies that has not yet had proven production potential in Pennsylvania. Although usually unreported, almost every well drilled through the Hamilton Group in Pennsylvania encounters gas in the Marcellus facies. This indicates that gas is widely present in the shale, and it may be that the Onondaga-Oriskany reservoirs in Pennsylvania receive contributions from the shale. The Marcellus is an unlikely primary target for exploration in the near future, however, as its great depth, combined with the current lack of sufficiently advanced technology needed to produce gas from organic-rich shales, makes it economically unattractive at this time.

As part of its resource inventory program, DOE is planning to core several wells in Pennsylvania during 1979 (Figure 27). The first of these wells, EGSP-PA #1, is located in McKean County south of Bradford. It will be drilled by Minard Run Oil Company, and approximately 800 feet of shale will be cored from the West Falls, Sonyea, and Genesee Formations and the Hamilton Group. The second well, EGSP-PA #2, located in southern Allegheny County east of the town of Monongahela, will be drilled by Combustion Engineering, Inc. Approximately 800 feet of core will be taken from the Genesee Formation and the Hamilton Group. Both coring projects will entail lithologic and fracture descriptions, fracture orientation, geochemical analysis, and gas-volume sampling, and the information gathered from these studies will be integrated with the resource assessment generated by the mapping project. A third core well, which would test the Dunkirk and Rhinestreet facies, is tentatively planned for Erie County.

The second phase of the Eastern Gas Shales Project in Pennsylvania has already begun. It will present more detailed information on limited intervals of the Middle and Upper Devonian by focusing on the individual major organic-rich shale facies. The first part of this phase will be concentrated on the "Perrysburg Formation" and particularly on the Dunkirk facies. The Java Formation and its Pipe Creek facies will be considered as a minor, but related, unit. The objective of the project is to provide detailed stratigraphic information concerning the "Perrysburg" and Java Formations, including defining and mapping the organic-rich shale facies and related rocks within the formations. These data will eventually be used to understand the sedimentological histories of the formations, and to help predict and evaluate potential natural-gas resources from these particular organic-rich shale facies. Future projects will concentrate on similar studies of the other major organic-rich shales, specifically: (1) the Rhinestreet facies of the West Falls Formation (also including the Sonyea and Genesee Formations as subsidiary units); and (2) the Marcellus facies of the Hamilton Group (also including the Tully Limestone and Mahantango Formation as subsidiary units).

Items Produced by the Pennsylvania Geological Survey for the Eastern Gas Shales Project

The following items produced for the Eastern Gas Shales Project are on open file and are available at the Pittsburgh Office of the Pennsylvania Geological Survey, 1201 Kossman Building, 100 Forbes Avenue, Pittsburgh, PA 15222.

(1) *Preliminary stratigraphic cross sections showing radioactive black shale zones and sandstones in the Middle and Upper Devonian, western Pennsylvania* (1977), by R. G. Piotrowski and S. A. Krajewski. Nine sections at vertical scale 1 inch = 100 feet.

(2) *Gas show and production map from Middle and Upper Devonian organic-rich shales in western and northern Pennsylvania* (1977), by R. G. Piotrowski and S. A. Krajewski. Scale 1:250,000.

(3) *Drilling depth map to the top of the Middle Devonian Onondaga Group* (1977), by R. G. Piotrowski and S. A. Krajewski. Scale 1:250,000.

(4) *Structure contour map on top of the Onondaga Group in western and northern Pennsylvania* (1977), by J. A. Harper and R. G. Piotrowski. Scale 1:250,000.

(5) *Final report: Black shale and sandstone facies of the Devonian "Catskill" clastic wedge in the subsurface of western Pennsylvania* (1979), by R. G. Piotrowski and J. A. Harper. A text and 39 isopach, structure, and lithofacies maps at a scale of 1:1,000,000 which encompass the entire Middle and Upper Devonian organic-rich shales and Upper Devonian sandstone zones depicted in Figure 26.

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A SUBSURFACE ROCK CORRELATION DIAGRAM, ALLEGHENY PLATEAU OF PENNSYLVANIA

by Louis Heyman

The diagram in Figure 29 is intended to summarize present understanding of regional relationships of the geologic section from the highest bedrock unit (Permian Greene Formation) to the base of the Middle Devonian Hamilton Group. It comprises the rock section lying above that shown in the correlation diagram on page 30 of *Oil and Gas Developments in Pennsylvania in 1976* (Lytle and others, 1977). The upper Middle Devonian (Tully Limestone and Hamilton Group) portion of this diagram repeats the corresponding part of the previous one, but also expresses current ideas about subsurface relations in this part of the rock column.

No attempt is made to portray time stratigraphy except where individual rock units happen to be time-parallel.

A sequence of facies and formation names is adopted for the Upper Devonian, largely from New York usage. Also shown is a letter and number zonal subdivision of the oil- and gas-producing part of the Upper Devonian sequence. Many hitherto widely used names (Canadaway, Conneaut, Conewango, etc.) are abandoned as meaningless when applied to the Pennsylvania subsurface. The Pennsylvania Geological Survey will hereafter use the nomenclature shown in Figure 29 when discussing the subsurface Upper Devonian.

Relations in the subsurface Carboniferous are based on U. S. Geological Survey Professional Paper 1110-B, *The Mississippian and Pennsylvanian*

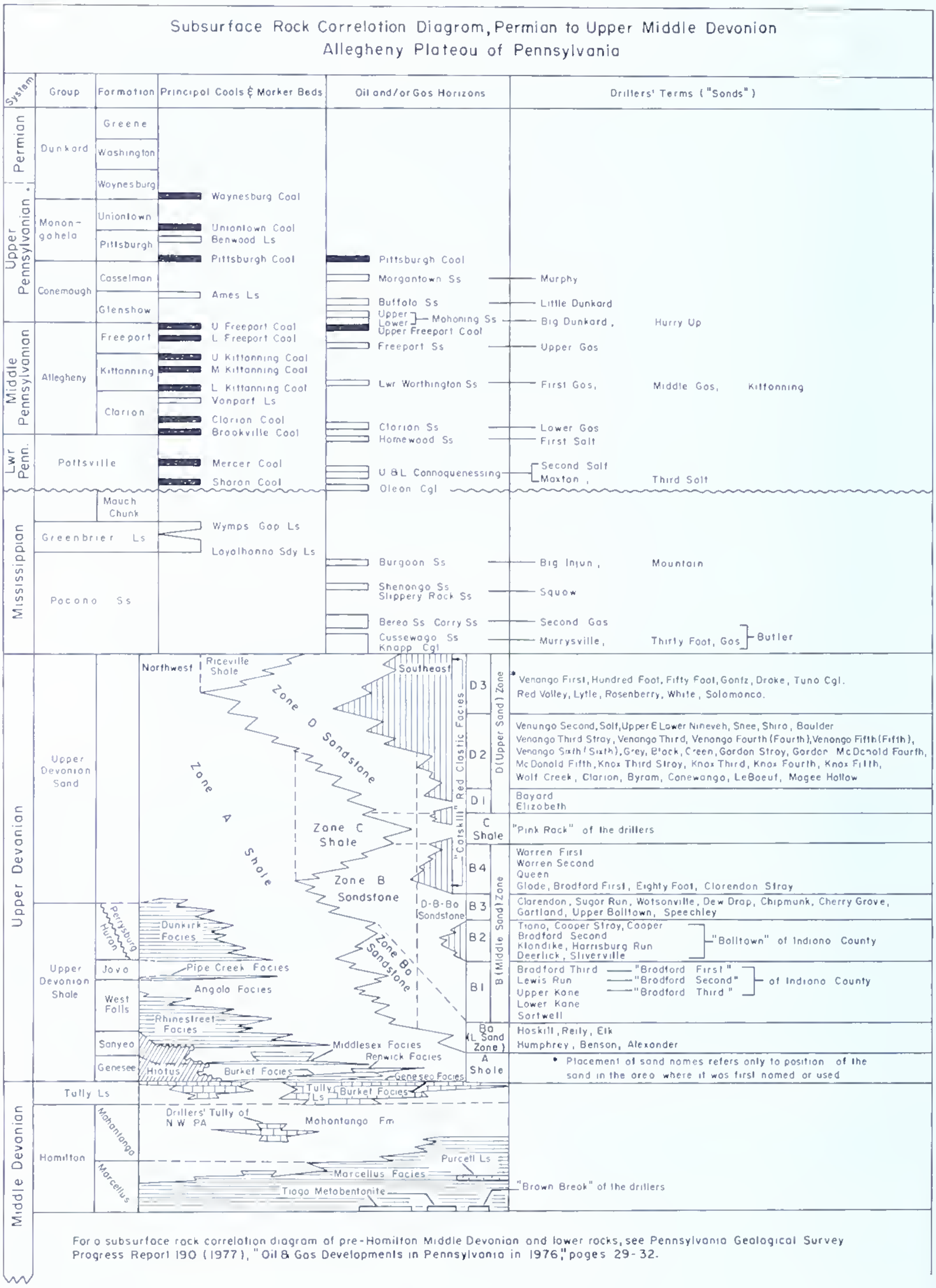

Figure 29. Subsurface rock correlation diagram, Permian to upper Middle Devonian, Allegheny Plateau of Pennsylvania

(Carboniferous) Systems in the United States—Pennsylvania and New York (Edmunds and others, 1979), especially the chapters on subsurface relations.

Middle and Lower Devonian correlations are based on a report made for the Morgantown Energy Technology Center of the U. S. Department of Energy, Morgantown, West Virginia, by the Pennsylvania Geological Survey, *Black Shale and Sandstone Facies of the Devonian "Catskill" Clastic Wedge in the Subsurface of Western Pennsylvania* (Piotrowski and Harper, 1979).

Larger versions of both correlation diagrams are available as open-file items from the Oil and Gas Geology Division of the Survey, 1201 Kossman Building, 100 Forbes Avenue, Pittsburgh, PA 15222.

References

Edmunds, W. E., Berg, T. M., Sevon, W. D., and others (1979), *The Mississippian and Pennsylvanian (Carboniferous) Systems in the United States—Pennsylvania and New York,* U. S. Geological Survey Professional Paper 1110-B, 33 p.

Lytle, W. S., Heyman, Louis, Piotrowski, R. G., and Krajewski, S. A. (1977), *Oil and gas developments in Pennsylvania in 1976,* Pennsylvania Geological Survey, 4th ser., Progress Report 190, 49 p.

Piotrowski, R. G., and Harper, J. A. (1979), *Black shale and sandstone facies of the Devonian "Catskill" clastic wedge in the subsurface of western Pennsylvania,* EGSP Series No. 13, Morgantown Energy Technology Center, Morgantown, West Virginia.

OPEN-FILE REPORTS AND OTHER DATA

The following reports and other data are available on open file at the Pennsylvania Geological Survey, Oil and Gas Geology Division, 1201 Kossman Building, 100 Forbes Avenue, Pittsburgh, PA 15222.

(1) *Surface to Middle Devonian (Onondagan) stratigraphy, Part I (STOMDES)* (1972), by D. R. Kelley and W. R. Wagner. 15 p., 8 cross sections, vertical scale 1 inch = 100 feet.

(2) *Deep sand exploration and gas developments in Pennsylvania* (1973), by Lillian A. Heeren. 1 map in 6 sheets, scale 1:250,000.

(3) *Salina or equivalent and deeper penetrations of Pennsylvania* (1973), by D. R. Kelley and L. J. Balogh. 1 map, scale 1:500,000.

(4) *Tully and deeper formations, brine analyses of Pennsylvania* (1973), by D. R. Kelley and L. A. Heeren. 1 chart and map, scale 1:500,000.

(5) *Stratigraphic framework of the Greater Pittsburgh area, Parts 1 and 2* (1972), by W. R. Wagner and W. S. Lytle. 20 p., 9 sections in 13 sheets.

(6) *Active gas storage fields map of Pennsylvania,* by L. J. Balogh. 1 map, scale 1:500,000.

(7) *A subsurface rock correlation diagram, surface to basement, Allegheny Plateau of Pennsylvania,* by Louis Heyman.

(8) *Preliminary stratigraphic cross sections showing radioactive black shale zones and sandstones in the Middle and Upper Devonian, western Pennsylvania* (1977), by R. G. Piotrowski and S. A. Krajewski. Nine sections at vertical scale 1 inch = 100 feet.

(9) *Gas show and production map from Middle and Upper Devonian organic-rich shales in western and northern Pennsylvania* (1977), by R. G. Piotrowski and S. A. Krajewski. 1 map, scale 1:250,000.

(10) *Drilling depth map to the top of the Middle Devonian Onondaga Group* (1977), by R. G. Piotrowski and S. A. Krajewski. 1 map, scale 1:250,000.

(11) *Structure contour map on top of the Onondaga Group in western and northern Pennsylvania* (1977), by J. A. Harper and R. G. Piotrowski. 1 map, scale 1:250,000.

(12) *Final report: Black shale and sandstone facies of the Devonian "Catskill" clastic wedge in the subsurface of western Pennsylvania* (1979), by R. G. Piotrowski and J. A. Harper. A text and 39 isopach, structure, and lithofacies maps at a scale of 1:1,000,000 which encompass the entire Middle and Upper Devonian organic-rich shales and Upper Devonian sandstone zones.

Also on open file at the Pennsylvania Geological Survey's Pittsburgh office are over 25,000 drillers' logs, along with 3,000 mechanical logs; a sample library containing approximately 1,200 wells, 90 of which are out-of-state wells; and a core library containing cores on approximately 40 wells.

SUMMARIZED RECORDS OF REPORTED DEEP WELLS IN 1978 THAT PENETRATED ROCKS OF MIDDLE DEVONIAN OR OLDER AGE

The information in Figure 30 has been compiled mainly from drillers' logs and location plats received from the Oil and Gas Regulatory Division, formerly in the Bureau of Land Protection and Reclamation and now in the Bureau of Topographic and Geologic Survey, Department of Environmental Resources. Other sources are Petroleum Information Corporation (PI), geophysical logs received by the Pennsylvania Geological Survey, and personal communications with oil and gas operators. Wells are filed with the Oil and Gas Regulatory Division by permit numbers. The Oil and Gas Geology Division assigns a file number which appears on the Survey's published and open-file maps.

A single asterisk appearing on a record indicates that all formation tops and total depths were picked from a geophysical log. A record without an asterisk means that the formation tops and total depths are from the driller's log. Where a double asterisk appears, the 7½-minute quadrangle name and location are given. The tables are listed alphabetically by county and by name of well.

COUNTY Permit Number		Blair 20010	Cambria 20078	Centre 20007	Clearfield 20705	Clearfield 20703	Clearfield 20651	Clearfield 20650	Clearfield 20767	Crawford 20542	Crawford 20530
NAME OF WELL		Blair Gap Water Supply #1	W. D. Wilson WN-1653	Texasgulf, Inc. #2	Helen Y. Hartzfeld #1	Samuel M. Leonard #1	Clarence Marshall #1	Antonio J. Palumbo	K. C. Smeal Unit #1	L. & W. Boyko #1	Wilbur Dunn Estate #1
OPERATOR		Texaco, Inc.	Consolidated Gas Supply Corp.	Amoco Production & UGI Development	Consolidated Gas Supply Corp.	Consolidated Gas Supply Corp.	Consolidated Gas Supply Corp.	Consolidated Gas Supply Corp.	Texaco, Inc.	Meridian Exploration	N-Ren Corp.
TOWNSHIP		Snyder	Susquehanna	Boggs	Brady	Brady	Brady	Huston	Boggs	Cambridge	Fairfield
QUADRANGLE & MAP NUMBER		Altoona B3 **Tipton	Barnesboro C39 **Barnesboro	Snow Shoe H6 **Snow Shoe, SE	Penfield G286 **Luthersburg	Penfield G289 **Luthersburg	Penfield G288 **Luthersburg	Penfield C287 **Penfield	Houtzdale C12 **Wallaceton	Cambdge Spgs I40 **Cambridge Spgs.	Meadville H45 **Cochranton
LATITUDE		8,490 ft. S 40°45'	4,300 ft. S 40°42'30"	12,050 ft. S 41°02'30"	10,400 ft. S 41°02'30"	4,600 ft. S 41°02'30"	5,050 ft. S 41°02'30"	900 ft. S 41°15'00"	13,000 ft. S 40°57'30"	7,600 ft. S 41°50'00"	8,700 ft. S 41°32'30"
LONGITUDE		3,550 ft. W 78°20'	6,050 ft. W 78°47'30"	4,450 ft. W 77°50'00"	9,400 ft. W 78°40'00"	3,550 ft. W 78°42'30"	10,000 ft. W 78°42'30"	7,100 ft. W 78°32'30"	6,475 ft. W 78°17'30"	6,750 ft. W 80°02'30"	2,450 ft. W 80°05'00"
DATE COMPLETED		3-23-78	9-17-78	7-7-78	11-25-77	10-29-77	8-21-77	10-8-77	5-11-78	1-22-78	7-14-77
ELEVATION		2231 KB	1646 KB	1975 GR	2023 KB	1754 KB	1655 GR	1330 GR	1997 KB	1145 GR	1365 GR
TULLY			*7548- 7611-Faulted		*6800-	*6413-	*6458-	*6224-	*7150-	*2412-	2660-?
ONONDAGA	LIMESTONE				7510-	7094-	7121- Gas @7125-7234	6826-	8108-	2622-	3406-?
	CHERT				7523-	7109-	7136-	6842-			
ORISKANY		7092-			7586-	7170-	7193-	6891-	8176- Gas @8176-82		Absent
HELDERBERG		7145-			7590- Gas	7175-	7202-	6918-			
KEYSER-BASS ISLAND										2785-	3602-?
SALINA										3170-	4114-
GUELPH-LOCKPORT										3494-	4127-?
BLACK WATER											
CLINTON											
IRONDEQUOIT										3822-	
MEDINA										3895- Gas @3941-4036	
WHIRLPOOL										4030-	
QUEENSTON										4042-	
TOTAL DEPTH		7145	8304	13059	7730	7258	7234	6934	8220	4140	4452
DEEPEST FORMATION REACHED		Helderberg	Tully	Tuscarora	Helderberg	Helderberg	Helderberg	Helderberg	Helderberg	Queenston	Lockport?
RESULT		Dry with trace of gas new field wildcat	291 Mcf AF 1,325 psi/14 days from Upper Devonian. PB to 3,453 feet Cherry Tree field extension	Dry and abandoned development Devils Elbow field	Dry and abandoned. Show of gas. Punxsutawney Driftwood field extension	152 Mcf AF 990 psi/16 days from Upper Devon. PB to 3,100 feet Salem pool	179 Mcf AF 2,425 psi/14 days development Rockton pool Punxsutawney-Driftwood field	Dry and abandoned. Show of gas development Boone Mountain field	734 Mcf AF 2,400 psi/63 days development West Decatur field	570 Mcf AF 1,085 psi/7 days extension Cambridge Springs field	Junked and abandoned new field wildcat

Figure 30. *(Continued)*

COUNTY Permit Number	Crawford 20531	Crawford 20544	Crawford 20529	Crawford 20532	Erie 20425	Erie 20476	Erie 20506	Erie 20540	Erie 20542	Erie 20599
NAME OF WELL	Michael Koss #1	Lord Kinematics #1	Amy K. Pion #1	Lyle W. Schaef #1	Lonnie L. Adam, Jr. #1	John Archer #4	John Archer #5	John Archer #6	John Archer #7	Robert Bard #1
OPERATOR	Meridian Oil and Gas Enterprises	Meridian Exploration Corporation	Meridian Oil and Gas Enterprises	Meridian Oil and Gas Enterprises	Centron Oil and Gas Corporation	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.
TOWNSHIP	Conneaut	Cambridge Springs	Summerhill	Conneaut	Conneaut	North East	North East	North East	North East	Harborcreek
QUADRANGLE & MAP NUMBER	Linesville C66 **Linesville	Cambdge Spgs I41 **Cambridge Spgs	Linesville C64 **Harmonsburg	Girard G474 **Beaver Center	Girard D475 **E. Springfield	North East B68 **Harborcreek	North East B76 **North East	North East 887 **Harborcreek	North East 8105 **Harborcreek	North East B114 **Harborcreek
LATITUDE	750 ft. S 41°45'00"	10,400 ft. S 41°50'00"	450 ft. S 41°45'00"	12,900 ft. S 41°47'30"	11,500 ft. S 41°55'00"	13,950 ft. S 42°15'00"	7,520 ft. 5 42°15'	12,300 ft. 5 42°15'00"	14,050 ft. 5 42°15'00"	2,300 ft. S 42°12'30"
LONGITUDE	5,200 ft. W 80°25'00"	5,900 ft. W 80°02'30"	6,550 ft. W 80°17'30"	8,600 ft. W 80°25'30"	10,950 ft. W 80°27'30"	6,900 ft. W 79°52'30"	4,900 ft. W 79°50'	4,650 ft. W 79°52'30"	4,950 ft. W 79°52'30"	7,025 ft. W 79°52'30"
DATE COMPLETED	11-13-77	2-8-78	12-19-77	11-21-77	8-14-77	3-15-78	4-17-78	6-10-78	7-25-78	8-27-78
ELEVATION	1166 GR	1166 GR	1319 KB	1154 GR	916 KB	730 GR	730 GR	750 GR	750 GR	740 GR
TULLY		*2440-			*1701-1729	*1130-1250	*1114-1230	*1141-1260	*1152-1270	*1179-1299
ONONDAGA LIMESTONE	*2447-	2652-	*2717-	*2422-	1871-	1350-	1331-	1363-	1376-	1401-
ONONDAGA CHERT										
ORISKANY	Absent	Absent	Absent	Absent	2128-	Absent	Absent	Absent	Absent	Absent
HELDERBERG						Absent	Absent	Absent	Absent	Absent
KEYSER-BASS ISLAND		2814-			2139-	1558-	1585-	1571-	1581-	1653-
SALINA		3200-			2218-	1700-	1709-	1727-	1738-	1758-
GUELPH-LOCKPORT	3370-	3525-		3341-	2756-	2058-	2046-	2068-	2081-	2108-
BLACK WATER										
CLINTON					3025-	2316-	2308-	2334-	2338-	2370-
IRONDEQUOIT	3705-	3854-	3970-	3678-	3095-	2365-	2358-	2378-	2388-	2421-
MEDINA WHIRLPOOL	3726- Gas @3761-3820	3942- Gas @3945-4068 4060-	4003- Oil & Gas @4047-88 4181-	3701- Gas @3753-3844 3890-	3123- Gas @3146-3198 3283-	2408- Gas @2421-2448 2540-	2390- Gas @2403-2473 2525- Gas	2390- Gas 2553- Gas	2430- Gas @2435-2544 2560- Gas	2447- Gas @2471-2574 2593- Gas
QUEENSTON	3923-	4072-	4191-	3914-?	3293-	2560-	2550-	2572-	2579-	2614-
TOTAL DEPTH	4050	4170	4234	3965	3330	2618	2637	2655	2657	2707
DEEPEST FORMATION REACHED	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston
RESULT	2,000 Mcf AF 20 BO AF 1,075 psi/3 days development Conneaut field	255 Mcf AF 1,171 psi/7 days development Cambridge Springs field	500 Mcf AF 10 BO AF 1,020 psi/3 days development Conneaut field	2,000 Mcf AF 2 BO AF 1,025 psi/3 days extension Indian Springs pool, Conneaut field	400 Mcf AF (est.) 745 psi/28 days development Conneaut field	318 Mcf AF 740 psi/10 days development Burgess pool North East field	1,100 Mcf AF 690 psi/10 days development Orchard Beach pool, North East field	782 Mcf AF 691 psi/10 days development Burgess pool North East field	428 Mcf AF 698 psi/10 days development Burgess pool North East field	782 Mcf AF 715 psi/10 days development Burgess pool North East field

COUNTY Permit Number	Erie 20517	Erie 20513	Erie 20514	Erie 20491	Erie 20623	Erie 20613	Erie 20418	Erie 20511	Erie 20512	Erie 20550
NAME OF WELL	James Bartlett #1	Robert Bartlett #1	Robert Bartlett #2	Bruno Bartman #1	Theodore Bauer #1	Theodore Bauer #2	Neil & Ruth Baxter #1	Carl Beckman #1	Carl Beckman #2	John & Dorothy Burek #1
OPERATOR	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Northwest Natural Gas Company	Envirogas, Inc.	Envirogas, Inc.	Northwest Natural Gas Company
TOWNSHIP	North East	North East	North East	North East	Harborcreek	Harborcreek	Conneaut	Harborcreek	Harborcreek	LeBoeuf
QUADRANGLE & MAP NUMBER	North East B103 **Harborcreek	North East B102 **North East	North East B98 **North East	North East C65 **North East	North East D134 **Harborcreek	North East D131 **Harborcreek	Girard E468 **E. Springfield	North East D96 **Harborcreek	North East D97 **Harborcreek	Union City E18 **Waterford
LATITUDE	900 ft. S 42°12'30"	6,100 ft. S 42°12'30"	7,850 ft. S 42°12'30"	1,650 ft. S 42°15'00"	6,650 ft. S 42°10'00"	8,500 ft. S 42°10'00"	2,500 ft. S 41°55'00"	300 ft. S 42°10'00"	250 ft. S 42°10'00"	10,100 ft. S 41°55'00"
LONGITUDE	4,400 ft. W 79°52'30"	2,050 ft. W 79°50'00"	2,450 ft. W 79°50'00"	4,200 ft. W 79°47'30"	5,650 ft. W 79°55'00"	6,650 ft. W 79°55'00"	7,850 ft. W 80°22'30"	5,675 ft. W 79°55'00"	3,625 ft. W 79°55'00"	9,860 ft. W 79°52'30"
DATE COMPLETED	7-19-78	6-25-78	7-10-78	3-10-78	10-18-78	10-2-78	6-29-77	6-10-78	5-29-78	6-24-78
ELEVATION	740 GR	950 GR	990 GR	645 KB	920 GR	1020 GR	924 DF	790 GR	810 GR	1305 GR
TULLY	*1150-1276	*1422-1546	*1490-1614	*1008-1132	*1498-1610	*1615-1728	*1703-1726	*1307-1420	*1336-1450	*2480-2552
ONONDAGA LIMESTONE	1383-	1648-	1383-	1233-	1721-	1840-	1874-	1525-	1553-	2709-
ONONDAGA CHERT										
ORISKANY	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
HELDERBERG	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
KEYSER-BASS ISLAND	1581-	1850-	1916-	1450-	1970-	2090-	2136-	1734-	1760-	2954-
SALINA	1729-	2013-	2085-	1560-	2084-	2240-	2206-	1886-	1924-	3065-
GUELPH-LOCKPORT BLACK WATER	2090-	2380-	2430-	1920-	2444-	2565-	2751-	2246-	2268-	3601-
CLINTON	2348-	2630-	2608-	2176-	2700-	2826-	2980-	2500-	2528-	3807-
IRONDEQUOIT	2399-	2683-	2747-	2224-	2754-	2876-	3088-	2555-	2584-	3924-
MEDINA WHIRLPOOL	2442- Gas @2455-2541 2570- Gas	2726- Gas @2743-2825 2850- Gas	2778-2804 Gas @2795-2881 2914- Gas	2256- Gas @2270-2359 2392-	2802- Gas @2805-2888 2932- Gas	2921- Gas @2924-3023 3053- Gas	3116- Gas @3152-3190 3200-(C. Head)	2598- Gas @2600-2705 2724- Gas	2610- Gas @2639-2729 2756-	3955- Gas @3984-4060 4119- Gas
QUEENSTON	2591-	2874-	2934-	2416-	2948-	3070-		2742-	2773-	4132-
TOTAL DEPTH	2665	2919	3005	2501	3017	3130	3268	2825	2852	4205
DEEPEST FORMATION REACHED	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Cabot Head	Queenston	Queenston	Queenston
RESULT	149 Mcf AF 720 psi/10 days development Burgess pool North East field	1,350 Mcf AF 840 psi/10 days development Orchard Beach pool North East field	2,100 Mcf AF 800 psi/10 days development Orchard Beach pool North East field	240 Mcf AF 790 psi/10 days development Orchard Beach pool North East field	473 Mcf AF 850 psi/10 days development Harborcreek pool Erie Deep field	138 Mcf AF 705 psi/10 days development Harborcreek pool Erie Deep field	1,300 Mcf AF 925 psi/4 days development Bushnell-Lexington pool Conneaut field	82 Mcf AF 730 psi/10 days development Harborcreek pool Erie Deep field	113 Mcf AF 770 psi/10 days development Harborcreek pool Erie Deep field	700 Mcf AF 1,050 psi/26 days extension New Ireland field

Figure 30. (Continued)

COUNTY Permit Number	Erie 20500	Erie 20590	Erie 20548	Erie 20570	Erie 20484	Erie 20545	Erie 20510	Erie 20536	Erie 20434	Erie 20444
NAME OF WELL	Clyde Burnham #1	Clyde Burnham #2	John Chizewick #1	Daniel Coletta #2	Sam Coletta #1	Vincent Coletta #2	J. Desin #1	Scott Emling #1	Carl & Ellen English #1	George F. Felton #1
OPERATOR	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Northwest Natural Gas Company	Envirogas, Inc.
TOWNSHIP	North East	Harborcreek	Harborcreek	North East	Harborcreek	Harborcreek	North East	Harborcreek	Conneaut	North East
QUADRANGLE & MAP NUMBER	North East C89 **North East	North East D119 **Harborcreek	North East A101 **Harborcreek	North East B121 **Harborcreek	North East B58 **Harborcreek	North East B93 **Harborcreek	North East B107 **Harborcreek	North East D117 **Harborcreek	Girard D472 **E. Springfield	North East C48 **North East
LATITUDE	4,550 ft. S 42°12'30"	2,950 ft. S 42°10'00"	4,225 ft. S 42°12'30"	7,950 ft. S 42°12'30"	15,050 ft. S 42°12'30"	13,050 ft. S 42°12'30"	2,500 ft. S 42°12'30"	2,490 ft. S 42°10'00"	14,350 ft. S 41°55'00"	2,200 ft. S 42°16'25"
LONGITUDE	8,850 ft. W 79°47'30"	6,400 ft. W 79°55'00"	1,250 ft. W 79°55'00"	4,250 ft. W 79°52'30"	8,200 ft. W 79°52'30"	5,600 ft. W 79°52'30"	5,450 ft. W 79°52'30"	2,500 ft. W 79°55'00"	1,900 ft. W 80°27'30"	4,050 ft. W 79°45'00"
DATE COMPLETED	6-10-78	8-31-78	6-30-78	8-23-78	2-15-78	6-25-78	8-20-78	6-18-78	7-18-77	9-15-77
ELEVATION	980 GR	830 GR	680 GR	800 GR	890 GR	890 GR	750 GR	870 GR	955 GR	600 GR
TULLY	*1453-1582	*1378-1472	*1129-1240	*1282-1336	*1420-1548	*1405-1540	*1182-1303	*1396-1513	1788-1827	1146-1336?
ONONDAGA LIMESTONE	1679-	1588-	1350-	1500-	1640-	1635-	1412-	1620-	*1937-	1392-?
ONONDAGA CHERT										
ORISKANY	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
HELDERBERG	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
KEYSER-BASS ISLAND	1882-	1798-	1551-	1738-	1865-	1840-	1611-	1870	2203?-	
SALINA	2060-	1949-	1676-	1862-	1990-	1981-	1702-	2180-	2280?-	1480-?
GUELPH-LOCKPORT	2414-	2303-	2053-	2213-	2348-	2340-	2110-	2338-	2834-	1836-
BLACK WATER										
CLINTON	2666-	2562-	2310-	2475-	2624-	2609-	2359-	2592-	3066-	*2048-
IRONDEQUOIT	2720-	2617-	2361-	2529-	2675-	2656-	2423-	2645-	3171-	2144-
MEDINA WHIRLPOOL	2754- Gas @2772-2863 2892- Gas	2650- Gas @2664-2763 2793- Gas	2404- Gas @2407-2504 2540- Gas	2555- Gas @2576-2677 2701- Gas	2705- Gas @2724-2813 2846- Gas	2700- Gas @2714-2791 2823- Gas	2465- Gas @2470-2584 2598- Gas	2678- Gas @2692-2689 2820- Gas	3200- Gas @3230-3312 3366-	*2158- Gas @2191-2323 2306- Gas
QUEENSTON	2906-	2809-	2556-	2724-	2867-	2850-	2619-	2837-	3378-	2324-
TOTAL DEPTH	2995	2891	2643	2803	2965	2920	2706	2928	3420	2430
DEEPEST FORMATION REACHED	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston
RESULT	782 Mcf AF 840 psi/10 days development Orchard Beach pool North East field	302 Mcf AF 825 psi/10 days development Harborcreek pool Erie Deep field	1,400 Mcf AF 770 psi/10 days development Harborcreek pool Erie Deep field	136 Mcf AF 819 psi/10 days development Burgess pool North East field	500 Mcf AF 825 psi/10 days development Burgess pool North East field	76 Mcf AF 737 psi/10 days development Burgess pool North East field	366 Mcf AF 758 psi/10 days development Burgess pool North East field	60 Mcf AF 675 psi/10 days development Erie Deep field	335 Mcf AF (est) 885 psi/2 days development Lundy's Lane pool Conneaut field	390 Mcf AF 742 psi/3 days extension Orchard Beach poo North East field

COUNTY Permit Number		Erie 20445	Erie 20523	Erie 20435	Erie 20505	Erie 20577	Erie 20450	Erie 20567	Erie 20424	Erie 20465	Erie 20508
NAME OF WELL		George F. Felton #2	Robert Finnell #1	John & Geraldine Frey #1	Thomas Fritts #1	Jack Garfield #1	General Electric #3	Walter Gribble #1	David & F. P. Guianen #2	Sterling A. Harris, Jr. #1	Casmir Hilinski #1
OPERATOR		Envirogas, Inc.	Envirogas, Inc.	Northwest Natural Gas Company	Envirogas, Inc.	Envirogas, Inc.	General Electric Company	Envirogas, Inc.	Eralco Natural Gas Development	Envirogas, Inc.	Envirogas, Inc.
TOWNSHIP		North East	Harborcreek	Conneaut	Greenfield	Harborcreek	Lawrence Park	North East	Conneaut	North East	Harborcreek
QUADRANGLE & MAP NUMBER		North East C49 **North East	North East A84 **Harborcreek	Girard D473 **Beaver Center	North East E95 **Hammett	North East D129 **Harborcreek	Erie F132 **Erie North	North East B127 **Harborcreek	Girard E470 **Albion	North East B73 **North East	North East D90 **Harborcreek
LATITUDE		4,150 ft. S 42°16'25"	9,820 ft. S 42°12'30"	600 ft. S 41°52'30"	2,400 ft. S 42°07'30"	1,375 ft. S 42°10'00"	7,250 ft. S 42°10'00"	10,950 ft. S 42°12'30"	1,800 ft. S 41°55'00"	6,050 ft. S 42°12'30"	4,200 ft. S 42°10'00"
LONGITUDE		4,000 ft. W 79°45'00"	3,550 ft. W 79°55'00"	2,000 ft. W 80°27'30"	4,500 ft. W 79°52'30"	8,400 ft. W 79°55'00"	4,650 ft. W 80°00'00"	5,400 ft. W 79°52'30"	6,825 ft. W 80°20'00"	4,250 ft. W 79°50'00"	4,500 ft. W 79°57'30"
DATE COMPLETED		1-2-78	5-9-78	7-23-77	7-10-78	10-16-78	11-6-77	9-4-78	8-3-77	11-29-77	4-28-78
ELEVATION		640 GR	720 GR	954 DF	1450 GR	780 GR	704 DF	840 GR	899 DF	900 GR	740 GR
TULLY		*1068-1100	*1191-1305	1791-1830	*2108-2230	*1292-1401	*1220-1320	*1354-1482	*1718-1750	*1381-1510	*1274-1384
ONONDAGA	LIMESTONE	1200-	1407-	*1948-	2336-	1513-	1492-	2493-	1902-	1604-	1497-
	CHERT										
ORISKANY		Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
HELDERBERG		Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
KEYSER-BASS ISLAND		1420-	1611-	2204-	2536-	1773-		1759-	2109-	1700-	1702-
SALINA		1546-	1770-	2286-	2706-	1874-		1944-	2220?-	2156-	1855-
GUELPH-LOCKPORT BLACK WATER		1896-	2120-	2840-	3075-	2226-		2296-	2776-	2318-	2222-
CLINTON		2152-	2387-	3072-	3338-	2484-	2402-	2554-	3010-	2578-	2486-
IRONDEQUOIT		2200-	2442-	3176-	3382-	2538-	2488-	2607-	3110-	2630-	2530-
MEDINA		2230- Gas @2252-2384	2464- Gas	3205- Gas @3258-3303	3418- Gas @3439-3513	2564- Gas	2498-	2639- Gas	3138- Gas @3172-3252	2674- Gas @2686-2819	2561- Gas @2573-2668
WHIRLPOOL		2368- Gas	2603- Gas	3370-	3560- Gas	2710- Gas		2780- Gas	3308-	2800- Gas	2704- Gas
QUEENSTON		2388-	2622-	3383-	3580-	2730-	2674-	2574-	3314-	2820-	2722-
TOTAL DEPTH		2480	2700	3419	3667	2806	2755	2879	3333	2949	2830
DEEPEST FORMATION REACHED		Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston
RESULT		958 Mcf AF 598 psi/10 days development Orchard Beach pool North East field	49 Mcf AF 820 psi/10 days development Erie Deep field	415 Mcf AF (est) 875 psi/4 days development Bushnell-Lexington pool Conneaut field	430 Mcf AF 980 psi/10 days New pool discovery Hornby pool North East field	366 Mcf AF 790 psi/10 days development Erie Deep field	30 Mcf (shallow) 20 psi/48 hrs. development Erie Shallow field Plugged back to 1450 feet	950 Mcf AF 815 psi/10 days development Burgess pool North East field	2,100 Mcf AF 880 psi/7 days development Bushnell-Lexington pool Conneaut field	1,200 Mcf AF 835 psi/10 days extension Orchard Beach pool North East field	735 Mcf AF 735 psi/10 days extension Erie Deep field

Figure 30. (Continued)

COUNTY Permit Number	Erie 20453	Erie 20530	Erie 20541	Erie 20547	Erie 20531	Erie 20607	Erie 20464	Erie 20555	Erie 20468	Erie 20568
NAME OF WELL	Julian A. Holzhausen #1	Earl & Helen Jant #1	Earl & Helen Jant #2	John Kloss #1	Joseph & Robert Kuzma #1	Arthur Larson #3	Virgil & Janet Leslie #1	George Levonduski #1	Glenn Lick et ux #1	Stephen Lloyd #1
OPERATOR	Envirogas, Inc.	Northwest Natural Gas Company	Northwest Natural Gas Company	Envirogas, Inc.	Northwest Natural Gas Company	Envirogas, Inc.	Northwest Natural Gas Company	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.
TOWNSHIP	North East	LeBoeuf	LeBoeuf	North East	LeBoeuf	North East	LeBoeuf	North East	North East	North East
QUADRANGLE & MAP NUMBER	North East 872 **North East	Union City E21 **Waterford	Union City E19 **Waterford	North East 0100 **North East	Union City 020 **Waterford	North East B130 **Harborcreek	Union City 016 **Waterford	North East 894 **Harborcreek	North East B74 **North East	North East B128 **North East
LATITUDE	4,850 ft. S 42°15'00"	9,850 ft. S 41°55'00"	11,200 ft. S 41°55'00"	3,200 ft. S 42°12'30"	3,500 ft. S 41°55'00"	6,450 ft. S 42°12'30"	4,350 ft. S 41°55'00"	13,850 ft. S 42°12'30"	7,650 ft. S 42°12'30"	12,500 ft. S 42°12'30"
LONGITUDE	600 ft. W 79°50'00"	3,850 ft. W 79°52'30"	3,800 ft. W 79°52'30"	10,400 ft. W 79°50'00"	9,350 ft. W 79°55'00"	3,000 ft. W 79°52'30'	3,400 ft. W 79°55'00"	7,300 ft. W 79°52'30"	4,200 ft. W 79°50'00"	275 ft. W 79°50'00"
DATE COMPLETED	11-5-77	5-14-78	6-3-78	6-25-78	5-23-78	9-9-78	11-5-77	7-10-78	12-8-77	9-18-78
ELEVATION	660 GR	1305 GR	1325 GR	782 GR	1255 GR	780 GR	1210 GR	870 GR	950 GR	1270 GR
TULLY	*1060-1180	*2520-2592	*2548-2620	*1250-1374	*2330-2402	*1271-1390	*2300-2369	*1398-1520	*1462-1590	*1817-1940
ONONDAGA LIMESTONE	1271-	2751-	2781-	1491-	2553-	1491-	2526-	1618-	1686-	2050-
ONONDAGA CHERT										
ORISKANY	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
HELDERBERG	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
KEYSER-BASS ISLAND	1479-	2989-	3031-	1476-	2803-	1711-	2712-	1820-	1827-	2301-
SALINA	1616-	3096-	3138-	1820-	2918-	1848-	2878-	1971-	2048-	2405-
GUELPH-LOCKPORT	1970-	3603-	3640-	2157-	3412-	2204-	3376-	2331-	2398-	2766-
BLACK WATER										
CLINTON	2236-	3823-	3869-	2438-	3640-	2463-	3600-	2596-	2659-	3024-
IRONDEQUOIT	2286-	3948-	3985-	2491-	3750-	2514-	3718-	2644-	2711-	3076-
MEDINA WHIRLPOOL	2312- Gas @2336-2470 2450- Gas	3978- Gas @4039-4066 4143- Gas	4016- Gas @4053-4125 4181- Gas	2540- Gas @2544-2609 2658- Gas	3781- Gas @3831-3886 3946- Gas	2548- Gas 2684- Gas	3748- Gas @3793-3840 3915- Gas	2672- Gas @2694-2776 2816- Gas	2758- Gas @2766-2900 2880- Gas	3105- Gas 3253- Gas
QUEENSTON	2474-	4154-	4193-	2688-	3954-	2706-	3927-	2838-	2904-	3270-
TOTAL DEPTH	2541	4202	4268	2780	4050	2771	3960	2921	2970	3347
DEEPEST FORMATION REACHED	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston
RESULT	891 Mcf AF 665 psi/10 days development Orchard Beach pool North East field	2,200 Mcf AF 1,180 psi/4 days discovery New Ireland field	540 Mcf AF 1,125 psi/14 days development New Ireland field	1,300 Mcf AF 800 psi/10 days development Burgess pool North East field	1,000 Mcf AF 1,130 psi/14 days development Erie Deep field	259 Mcf AF 760 psi/10 days development Burgess pool North East field	1,750 Mcf AF 875 psi/2 days development Erie Deep field	1,800 Mcf AF 850 psi/10 days development Burgess pool North East field	4,600 Mcf AF 854 psi/10 days development Orchard Beach pool North East field	212 Mcf AF 838 psi/10 days development Orchard Beach pool North East field

COUNTY Permit Number	Erie 20486	Erie 20487	Erie 20488	Erie 20446	Erie 20620	Erie 20470	Erie 20497	Erie 20498	Erie 20522	Erie 20452
NAME OF WELL	Carlton W. Luke #1	Carlton W. Luke #2	Fred C. Luke #1	Massey & Sample #1	Clifford Maynard #1	Angelo Mazza #1	McCord Vineyards #2	McCord Vineyards #3	John McGaughey #1	Raymond U. Mead #1
OPERATOR	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.
TOWNSHIP	North East	North East	North East	North East	North East	North East	North East	North East	North East	North East
QUADRANGLE & MAP NUMBER	North East B60 **North East	North East B61 **North East	North East B62 **North East	North East C70 **North East	North East B133 **Harborcreek	North East C53 **North East	North East B75 **Harborcreek	North East B81 **Harborcreek	North East C99 **North East	North East C71 **North East
LATITUDE	9,675 ft. S 42°15'00"	12,800 ft. S 42°15'00"	12,200 ft. S 42°15'00"	6,150 ft. S 42°15'00"	4,000 ft. S 42°12'30"	8,150 ft. S 42°15'00"	12,400 ft. S 42°15'00"	13,200 ft. S 42°15'00"	6,150 ft. S 42°15'00"	4,400 ft. S 42°15'00"
LONGITUDE	5,000 ft. W 79°50'00"	5,160 ft. W 79°50'00"	6,850 ft. W 79°50'00"	3,500 ft. W 79°47'30"	6,300 ft. W 79°52'30"	2,600 ft. W 79°47'30"	1,000 ft. W 79°52'30"	1,000 ft. W 79°52'30"	6,650 ft. W 79°45'00"	3,650 ft. W 79°47'30"
DATE COMPLETED	2-22-78	2-23-78	3-1-78	10-29-77	11-10-78	2-4-78	4-24-78	3-20-78	5-28-78	11-5-77
ELEVATION	750 GR	710 GR	775 KB	760 GR	730 GR	810 GR	750 GR	750 GR	820 GR	700 GR
TULLY	*1156-1232	*1118-1260	*1154-1264	*1190-1316	*1175-1293	*1240-1313	*1154-1270	*1162-1280	*1254-1398	*1102-1234
ONONDAGA LIMESTONE	1373-	1356-	1405-	1413-	1400-	1468-	1375-	1384-	1485-	1328-
ONONDAGA CHERT										
ORISKANY	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
HELDERBERG	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
KEYSER-BASS ISLAND SALINA	1623- 1730-	1603- 1718-	1608- 1762-	1612- 1756-	1645- 1752-	1664- 1813-	1581- 1720-	1590- 1733-	1687- 1826-	1537- 1640-
GUELPH-LOCKPORT BLACK WATER	2088-	2080-	2110-	2100-	2103-	2158-	2078-	2058-	2170-	2012-
CLINTON IRONDEQUOIT	2350- 2398-	2334- 2384-	2376- 2425-	2364- 2408-	2366- 2416-	2418- 2456-	2349- 2390-	2345- 2394-	2430- 2478-	2272- 2321-
MEDINA WHIRLPOOL	2446- Gas @2448-2544 2566- Gas	2414- Gas @2429-2523 2550- Gas	2459- Gas @2472-2530 2594- Gas	2444- Gas @2462-2598 2581- Gas	2460- Gas Gas @2463-2559 2587- Gas	2494- Gas @2513-2605 2634- Gas	2434- Gas @2438-2537 2552- Gas	2441- Gas 2666- Gas	2526- Gas @2528-2589 2644- Gas	2365- Gas @2369-2507 2490- Gas
QUEENSTON	2593-	2575-	2616-	2602-	2609-	2656-	2584-	2588-	2665-	2510-
TOTAL DEPTH	2684	2658	2705	2682	2700	2688	2669	2680	2744	2594
DEEPEST FORMATION REACHED	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston
RESULT	750 Mcf AF 700 psi/10 days development Orchard Beach pool North East field	500 Mcf AF 712 psi/10 days development Orchard Beach pool North East field	250 Mcf AF 665 psi/10 days development Orchard Beach pool North East field	1,000 Mcf AF 860 psi/10 days development Orchard Beach pool North East field	782 Mcf AF 735 psi/10 days development Burgess pool North East field	550 Mcf AF 725 psi/10 days development Orchard Beach pool North East field	4,400 Mcf AF 754 psi/10 days development Burgess pool North East field	449 Mcf AF 775 psi/10 days development Burgess pool North East field	667 Mcf AF 787 psi/10 days development Orchard Beach pool North East field	1,089 Mcf AF 712 psi/10 days development Orchard Beach pool North East field

Figure 30. *(Continued)*

COUNTY Permit Number		Erie 20485	Erie 20471	Erie 20440	Erie 20441	Erie 20501	Erie 20499	Erie 20489	Erie 20490	Erie 20566	Erie 20502
NAME OF WELL		Douglas Meehl #1	Leo Merski #1	Modern Industries #1	Modern Industries #2	David Moorhead #1	David Moorhead #2	John Moorhead #1	John Moorhead #2	Robert Moorhead #1	Moorhead Vineyards #1
OPERATOR		Envirogas, Inc.	Envirogas, Inc.	Modern Industries Incorporated	Modern Industries Incorporated	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.
TOWNSHIP		North East	North East	City of Erie	City of Erie	Harborcreek	Harborcreek	Harborcreek	Harborcreek	North East	Harborcreek
QUADRANGLE & MAP NUMBER		North East C59 **North East	North East C106 **North East	Erie E130 **Erie South	Erie E131 **Erie South	North East B83 **Harborcreek	North East B82 **Harborcreek	North East B63 **Harborcreek	North East B64 **Harborcreek	North East B110 **Harborcreek	North East B66 **Harborcreek
LATITUDE		2,150 ft. S 42°12'30"	8,575 ft. S 42°16'25"	5,050 ft. S 42°07'30"	1,300 ft. S 42°07'30"	5,800 ft. S 42°12'30"	3,550 ft. S 42°12'30"	5,250 ft. S 42°12'30"	3,750 ft. S 42°12'30"	9,350 ft. S 42°12'30"	7,300 ft. S 42°12'30"
LONGITUDE		11,100 ft. W 79°47'30"	3,800 ft. W 79°47'30"	6,450 ft. W 80°05'00"	8,050 ft. W 80°05'00"	11,100 ft. W 79°52'30"	10,750 ft. W 79°52'30"	9,200 ft. W 79°52'30"	7,950 ft. W 79°52'30"	6,600 ft. W 79°52'30"	9,950 ft. W 79°52'30"
DATE COMPLETED		2-26-78	8-11-78	9-5-77	9-23-77	3-20-78	4-10-78	2-24-78	3-3-78	7-16-78	3-11-78
ELEVATION		860 GR	620 GR	700 GR	648 KB	690 GR	690 GR	710 KB	700 KB	800 GR	740 GR
TULLY		*1316-1440	* 980-1110	*1250-1335	1159-1240	*1150-1266	*1136-1250	*1190-1308	*1140-1260	*1295-1412	*1210-1330
ONONDAGA	LIMESTONE	1539-	1208-	1465-	1372-	1369-	1353-	1412-	1362-	1514-	1431-
	CHERT										
ORISKANY		Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
HELDERBERG		Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
KEYSER-BASS ISLAND		1740-	1406-	1728-		1576-	1560-	1660-	1570-	1719-	1638-
SALINA		1910-	1544-			1747-	1713-	1770-	1710-	1872-	1782-
GUELPH-LOCKPORT		2256-	1894-	2110-		2076-	2050-	2114-	2068-	2224-	2140-
BLACK WATER											
CLINTON		2528-	2150-			2332-	2316-	2380-	2328-	2484-	2404-
IRONDEQUOIT		2580-	2199-	2525-		2386-	2366-	2425-	2375-	2539-	2454-
MEDINA		2614- Gas @2627-2714	2244- Gas @2247-2334	2560- Gas	2440- Gas	2414- Gas	2408- Gas	2474- Gas @2476-2567	2410- Gas @2436-2524	2564- Gas @2592-2681	2484- Gas @2502-2599
WHIRLPOOL		2746- Gas	2366- Gas	2700- Gas		2558- Gas	2541- Gas	2602- Gas	2555- Gas	2707- Gas	2636- Gas
QUEENSTON		2769-	2385-	2717-	2612-	2581-	2561-	2624-	2578-	2732-	2648-
TOTAL DEPTH		2844	2454	2761	2780	2668	2634	2717	2660	2815	2742
DEEPEST FORMATION REACHED		Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston
RESULT		360 Mcf AF 782 psi/10 days development Orchard Beach pool North East field	302 Mcf AF 744 psi/10 days development Orchard Beach pool North East field	1,109 Mcf AF 825 psi/7 days development Erie Deep field	723 Mcf AF 843 psi/7 days development Erie Deep field	1,170 Mcf AF 758 psi/10 days development Burgess pool North East field	958 Mcf AF 760 psi/10 days development Burgess pool North East field	3,200 Mcf AF 704 psi/10 days development Burgess pool North East field	1,400 Mcf AF 805 psi/10 days development Burgess pool North East field	950 Mcf AF 835 psi/10 days development Burgess pool North East field	490 Mcf AF 742 psi/10 days development Burgess pool North East field

COUNTY Permit Number	Erie 20503	Erie 20472	Erie 20556	Erie 20596	Erie 20612	Erie 20539	Erie 20524	Erie 20575	Erie 20526	Erie 20527
NAME OF WELL	Moorhead Vineyards #2	Nels A. Nelson #1	North East Township #1	Edward Orton #1	Howard Orton #2	Jack Paschke #1	Alfred Pero #1	Archibald Phillips #1	John Phillips #1	John Phillips #2
OPERATOR	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.
TOWNSHIP	Harborcreek	Harborcreek	North East	North East	North East	North East	North East	North East	North East	North East
QUADRANGLE & MAP NUMBER	North East A69 **Harborcreek	North East A54 **Harborcreek	North East B126 **North East	North East C124 **North East	North East C125 **North East	North East C108 **North East	North East C85 **North East	North East C122 **North East	North East 879 **North East	North East C86 **North East
LATITUDE	8,600 ft. S 42°12'30"	3,200 ft. S 42°12'30"	15,150 ft. S 42°10'00"	6,350 ft. S 42°15'00"	11,350 ft. S 42°12'30"	7,180 ft. S 42°15'00"	8,125 ft. S 42°15'00"	1,270 ft. S 42°15'00"	7,850 ft. S 42°15'00"	9,550 ft. S 42°15'00"
LONGITUDE	50 ft. W 79°55'00"	5,300 ft. W 79°55'00"	7,850 ft. W 79°50'00"	10,700 ft. W 79°45'00"	9,900 ft. W 79°47'30"	7,950 ft. W 79°45'00"	4,400 ft. W 79°47'30"	9,050 ft. W 79°45'00"	6,800 ft. W 79°47'30"	5,450 ft. W 79°47'30"
DATE COMPLETED	4-18-78	1-10-78	11-3-78	9-29-78	9-2-78	6-5-78	5-13-78	9-23-78	5-23-78	6-4-78
ELEVATION	750 KB	680 GR	760 GR	770 GR	1270 GR	820 GR	800 GR	700 GR	760 GR	810 GR
TULLY	*1216-1340	*1088-1180	*1204-1318	*1198-1322	*1792-1916	*1264-1400	*1236-1364	*1075-1208	*1190-1314	*1257-1386
ONONDAGA LIMESTONE	1433-	1312-	1437-	1422-	2022-	1494-	1459-	1309-	1410-	1479-
ONONDAGA CHERT										
ORISKANY	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
HELDERBERG	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
KEYSER-BASS ISLAND	1641-	1520-	1667-	1655-	2251-	1694-	1655-	1549-	1607-	1678-
SALINA	1802-	1660-	1768-	1764-	2372-	1812-	1802-	1644-	1750-	1828-
GUELPH-LOCKPORT	2144-	2018-	2118-	2107-	2746-	2178-	2157-	1993-	2100-	2168-
BLACK WATER										
CLINTON	2405-	2280-	2387-	2366-	3011-	2435-	2404-	2251-	2362-	2429-
IRONDEQUOIT	2453-	2324-	2440-	2419-	3060-	2482-	2450-	2300-	2410-	2480-
MEDINA	Gas @2501-2579	2370- Gas @2370-2473	2483- Gas	2448- Gas @2468-2556	3105- Gas @3111-3199	2513- Gas @2534-2616	2480- Gas	2345- Gas @2348-2436	2456- Gas	2506- Gas
WHIRLPOOL	2626- Gas	2500- Gas	2610- Gas	2586- Gas	3230- Gas	2652- Gas	2624- Gas	2471- Gas	2582- Gas	2646- Gas
QUEENSTON	2648-	2522-	2630-	2606-	3249-	2672-	2644-	2489-	2601-	2667-
TOTAL DEPTH	2741	2560	2705	2685	3326	2760	2730	2587	2705	2760
DEEPEST FORMATION REACHED	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston
RESULT	2,120 Mcf AF 759 psi/10 days development Erie Deep field	1,300 Mcf AF 780 psi/10 days development Erie Deep field	2,270 Mcf AF 830 psi/10 days development Orchard Beach pool North East field	366 Mcf AF 686 psi/10 days development Orchard Beach pool North East field	1,890 Mcf AF 840 psi/10 days extension Orchard Beach pool North East field	1,100 Mcf AF 838 psi/10 days development Orchard Beach pool North East field	428 Mcf AF 720 psi/10 days development Orchard Beach pool North East field	2,270 Mcf AF 680 psi/10 days development Orchard Beach pool North East field	300 Mcf AF 755 psi/10 days development Orchard Beach pool North East field	473 Mcf AF 760 psi/10 days development Orchard Beach pool North East field

Figure 30. *(Continued)*

COUNTY Permit Number	Erie 20528	Erie 20546	Erie 20495	Erie 20427	Erie 20423	Erie 20466	Erie 20477	Erie 20532	Erie 20469	Erie 20578
NAME OF WELL	John Phillips #3	John Phillips #4	Souhail Rahal #1	J. C. & I. P. Rakovan #1	Andrew & Martha Revak #2	John Sandhoff #1	Roger Seblink #1	Frank Semelka #1	William Semelka #1	John Sheridan #1
OPERATOR	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Northwest Natural Gas Company	Northwest Natural Gas Company	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.
TOWNSHIP	North East	North East	North East	Conneaut	Conneaut	North East	North East	North East	North East	Harborcreek
QUADRANGLE & MAP NUMBER	North East C112 **North East	North East C113 **North East	North East C88 **North East	Girard 0471 **E. Springfield	Girard 0469 **E. Springfield	North East 851 **North East	North East C56 **North East	North East C92 **North East	North East C52 **North East	North East 8118 **Harborcreek
LATITUDE	9,550 ft. S 42°15'00"	225 ft. S 42°15'00"	7,075 ft. S 42°15'00"	14,850 ft. S 41°55'00"	13,050 ft. S 41°55'00"	5,900 ft. S 42°15'00"	4,050 ft. S 42°15'00"	3,900 ft. S 42°15'00"	3,050 ft. S 42°15'00"	13,450 ft. S 42°12'30"
LONGITUDE	7,300 ft. W 79°47'30"	720 ft. W 79°47'30"	800 ft. W 79°47'30"	5,700 ft. W 80°27'30"	6,100 ft. W 80°27'30"	4,750 ft. W 79°50'00"	5,150 ft. W 79°45'00"	6,900 ft. W 79°45'00"	7,350 ft. W 79°47'30"	2,850 ft. W 79°55'00"
DATE COMPLETED	8-3-78	8-10-78	3-7-78	7-14-77	7-10-77	12-14-77	1-20-78	5-23-78	1-27-78	9-9-78
ELEVATION	800 GR	660 GR	790 GR	955 GR	935 GR	660 GR	790 GR	730 GR	630 GR	780 GR
TULLY	*1230-1367	*1004-1136	*1230-1360	1777-1816	*1752-1792	*1090-1202	*1200-1272	*1090-1224	*1008-1100	*1289-1400
ONONDAGA LIMESTONE	1464-	1232-	1456-	*1934-	1914-	1306-	1430-	1320-	1250-	1506-
ONONDAGA CHERT										
ORISKANY	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
HELDERBERG	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
KEYSER-BASS ISLAND	1661-	1430-		2236-	2218-	1512-	1670-	1522-	1447-	1754-
SALINA	1804-	1567-	1793-	2313-	2290-	1666-	1780-	1660-	1584-	1867-
GUELPH-LOCKPORT	2150-	1916-	2146-	2834-	2806-	2020-	2112-	2008-	1936-	2221-
BLACK WATER										
CLINTON	2415-	2177-	2403-	3063-	3038-	2283-	2374-	2266-	2200-	2484-
IRONDEQUOIT	2463-	2236-	2450-	3168-	3140-	2330-	2424-	2318-	2245-	2532-
MEDINA	2512- Gas @2517-2600	2270- Gas @2273-2366	2478- Gas @2503-2589	3196- Gas	3168- Gas @3221-3278	2358- Gas @2381-2519	2456- Gas @2477-2554	2364- Gas @2375-2456	2270- Gas Oil @2293-2378	2568- Gas @2588-2676
WHIRLPOOL	2640- Gas	2393- Gas	2620- Gas	3367-	3332-	2500- Gas	2594- Gas	2486- Gas	2406- Gas	2707- Gas
QUEENSTON	2657-	2413-	2641-	3373-	3340-	2524-	2616-	2504-	2430-	2724-
TOTAL DEPTH	2732	2504	2720	3390	3357	2605	2705	2590	2530	2806
DEEPEST FORMATION REACHED	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston
RESULT	329 Mcf AF 782 psi/10 days development Orchard Beach pool North East field	1,750 Mcf AF 765 psi/10 days development Orchard Beach pool North East field	473 Mcf AF 755 psi/10 days development Orchard Beach pool North East field	270 Mcf AF 740 psi/3 days development Bushnell-Lexington pool Conneaut field	1,100 Mcf AF(est) 895 psi/3 days development Bushnell-Lexington pool Conneaut field	1,100 Mcf AF 721 psi/10 days development Orchard Beach pool North East field	1,750 Mcf AF 585 psi/10 days development Orchard Beach pool North East field	329 Mcf AF 763 psi/10 days development Orchard Beach pool North East field	700 Mcf AF and est. 5 BOPD 550 psi/10 days development Orchard Beach pool	60 Mcf AF 670 psi/10 days development Erie Deep field

COUNTY Permit Number	Erie 20614	Erie 20448	Erie 20483	Erie 20525	Erie 20579	Erie 20544	Erie 20519	Erie 20518	Erie 20478	Erie 20479
NAME OF WELL	Enoch Smith #1	Marg. B. Southwick #2	James Sul #1	Robert Swift #1	Szklenski Farms #1	Szklenski Farms #2	Szklenski Farms #3	Myron Treter #1	Clifford & Cletus Troyer #3	Clifford & Cletus Troyer #4
OPERATOR	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	Envirogas, Inc.	C & C Troyer Bros	C & C Troyer Bros
TOWNSHIP	North East	North East	Harborcreek	Harborcreek	Harborcreek	Harborcreek	Harborcreek	Harborcreek	Waterford	Waterford
QUADRANGLE & MAP NUMBER	North East C132 **North East	North East C67 **North East	North East A57 **Harborcreek	North East A78 **Harborcreek	North East B123 **Harborcreek	North East B109 **Harborcreek	North East A104 **Harborcreek	North East A91 **Harborcreek	Union City A22 **Waterford	Union City A23 **Waterford
LATITUDE	13,000 ft. S 42°12'30"	4,400 ft. S 42°15'00"	7,550 ft. S 42°12'30"	8,300 ft. S 42°12'30"	13,750 ft. S 42°12'30"	12,600 ft. S 42°12'30"	11,900 ft. S 42°12'30"	1,050 ft. S 42°12'30"	12,525 ft. S 41°57'30"	14,075 ft. S 41°57'30"
LONGITUDE	8,000 ft. W 79°47'30"	10,700 ft. W 79°45'00"	2,225 ft. W 79°55'00"	4,050 ft. W 79°55'00"	9,775 ft. W 79°52'30"	8,600 ft. W 79°52'30"	250 ft. W 79°55'00"	100 ft. W 79°55'00"	6,775 ft. W 79°55'00"	6,475 ft. W 79°55'00"
DATE COMPLETED	9-27-78	11-23-77	2-6-78	5-16-78	10-10-78	8-20-78	6-19-78	5-26-78	3-17-78	3-4-78
ELEVATION	1280 GR	760 GR	690 GR	690 GR	850 GR	842 GR	790 GR	670 GR	1225 GR	1200 GR
TULLY	*1836-1920	*1157-1286	*1150-1280	*1150-1268	*1353-1467	*1347-1460	*1290-1406	*1092-1204	*2236-2307	*2225-2296
ONONDAGA LIMESTONE	2073-	1386-	1380-	1366-	1574-	1574-	1508-	1309-	2462-	2450-
ONONDAGA CHERT										
ORISKANY	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
HELDERBERG	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
KEYSER-BASS ISLAND	2314-	1616-	1576-	1572-	1831-	1770-	1710-	1515-	2706-	2693-
SALINA	2431-	1730-	1754-	1726-	1930-	1934-	1864-	1658-	2826-	2812-
GUELPH-LOCKPORT	2794-	2070-	2094-	2078-	2286-	2280-	2216-	2011-	3344-	3335-
BLACK WATER										
CLINTON	3056-	2330-	2352-	2338-	2551-	2536-	2477-	2272-	3557-	3547-
IRONDEQUOIT	3108-	2380-	2400-	2386-	2601-	2590-	2530-	2324-	3666-	3656-
MEDINA	3134- Gas	2424- Gas @2432-2561	2446- Gas @2449-2549	2430- Gas	2628- Gas @2660-2737	2634- Gas @2639-2721	2570- Gas @2575-2671	2361- Gas @2387-2466	3696- Gas @3759-3788	3687- Gas @3752-3772
WHIRLPOOL	3284- Gas	2548- Gas	2574- Gas	2560- Gas	2769- Gas	2760- Gas	2701 - Gas	2495- Gas	3862- Gas	3852- Gas
QUEENSTON	3301-	2566-	2594-	2580-	2788-	2783-	2723-	2520-	3873-	3863-
TOTAL DEPTH	3364	2630	2695	2655	2900	2860	2810	2604	3905	3958
DEEPEST FORMATION REACHED	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston
RESULT	677 Mcf AF 794 psi/10 days development Orchard Beach pool North East field	422 Mcf AF 744 psi/10 days development Orchard Beach pool North East field	160 Mcf AF 735 psi/10 days development Erie Deep field	76 Mcf AF 670 psi/10 days development Erie Deep field	677 Mcf AF 759 psi/10 days development Burgess pool North East field	1,200 Mcf AF 875 psi/10 days development Burgess pool North East field	212 Mcf AF 810 psi/10 days development Erie Deep field	800 Mcf AF 760 psi/10 days development Erie Deep field	1,700 Mcf AF 1,115 psi/4 days development Erie Deep field	750 Mcf AF 1,050 psi/4 days development Erie Deep field

Figure 30. *(Continued)*

COUNTY Permit Number		Erie 20447	Erie 20619	Erie 20516	Erie 20473	Erie 20474	Erie 20417	Erie 20462	Erie 20463	Erie 20475	Erie 20507
NAME OF WELL		Charles L. Valone #2	The Warren Company #1	Wayne Corporation #1	Max V. Weaver et ux #1	Max V. Weaver et ux #2	Richard & Marie Weislogel #1	Welch Foods, Inc. #4	Welch Foods, Inc. #5	George & Alice Wheeler #2	Robert Whitney #1
OPERATOR		Envirogas, Inc.	The Warren Company	Wayne Corporation	Envirogas, Inc.	Envirogas, Inc.	Northeast Heat & Light Company	Welch Foods, Inc.	Welch Foods, Inc.	Northwest Natural Gas Company	Envirogas, Inc.
TOWNSHIP		North East	Millcreek	Millcreek	Harborcreek	Harborcreek	Conneaut	North East	North East	LeBoeuf	Harborcreek
QUADRANGLE & MAP NUMBER		North East 850 **North East	Erie E135 **Swanville	Erie E134 **Swanville	North East 8111 **Harborcreek	North East 855 **Harborcreek	Girard E467 **E. Springfield	North East 8115 **North East	North East 8116 **North East	Union City 017 **Waterford	North East 077 **Harborcreek
LATITUDE		9,800 ft. S 42°15'00"	13,800 ft. S 42°07'30"	8,400 ft. S 42°07'30"	13,700 ft. S 42°15'00"	600 ft. S 42°12'30"	4,250 ft. S 41°55'00"	550 ft. S 42°12'30"	2,650 ft. S 42°12'30"	2,600 ft. S 41°55'00"	5,000 ft. S 42°10'00"
LONGITUDE		6,600 ft. W 79°50'00"	8,150 ft. W 80°07'30"	2,050 ft. W 80°07'30"	9,850 ft. W 79°52'30"	9,150 ft. W 79°52'30"	3,200 ft. W 80°22'30"	1,250 ft. W 79°50'00"	2,900 ft. W 79°50'00"	4,050 ft. W 79°55'00"	4,650 ft. W 79°55'00"
DATE COMPLETED		11-3-77	10-13-78	5-8-78	9-15-78	12-29-77	6-14-77	3-19-78	3-19-78	10-31-77	5-9-78
ELEVATION		750 GR	724 GR	724 DF	650 GR	690 GR	880 GR	790 GR	830 GR	1214 DF	900 GR
TULLY		*1116-1211	*1300-1346	1247-1297	*1073-1184	*1092-1176	1691-1714	*1230-1282	*1273-1322	*2274-2343	*1470-1576
ONONDAGA	LIMESTONE	1354-	1504-	1463-1465	1294	1312-	*1863-	1454-	1500-	2500-	1688-
	CHERT										
ORISKANY		Absent	Absent		Absent	Absent	Absent	Absent	Absent	Absent	Absent
HELDERBERG		Absent	Absent		Absent	Absent	Absent	Absent	Absent	Absent	Absent
KEYSER-BASS ISLAND		1603-	1790-		1556-	1562-	2120-	1710-	1760-	2744-	1894-
SALINA		1710-			1653-	1666-	2198-			2858-	2050-
GUELPH-LOCKPORT BLACK WATER		2062-			2000-	2016-	2733-	2172-	2215-	3360-	2414-
CLINTON		2332-	2570-		2258-	2276-	2965-	2435-	2470-	3586-	2670-
IRONDEQUOIT		2374-			2310-	2328-	3071-	2489-	2528-	3694-	2720-
MEDINA WHIRLPOOL		2420- Gas @2440-2561 2544- Gas	2595- Gas @2631-2773		2342- Gas @2355-2497 2480- Gas	2374- Gas 2500- Gas	3100- Gas 3268-	2532- Gas @2565-2688 2660- Gas	2570- Gas @2578-2606 2695-	3724- Gas @3770-3820 3891- Gas	2753- Gas 2898- Gas
QUEENSTON		2567-	2775-		2499-	2520-	3274-	2676-	2713-	3902-	2915-
TOTAL DEPTH		2657	2845	1465	2582	2553	3289	2800	2780	3997	2994
DEEPEST FORMATION REACHED		Queenston	Queenston	Onondaga	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston
RESULT		1,500 Mcf AF 660 psi/10 days development Orchard Beach pool North East field	545 Mcf AF 860 psi/14 days development Charter Oaks field	363 Mcf Nat. 57 psi/10 days development producing from Devonian shale Erie Shallow field	428 Mcf AF 650 psi/10 days development Burgess pool North East field	550 Mcf AF 680 psi/10 days development Burgess pool North East field	1,200 Mcf AF 885 psi/4 days development Bushnell-Lexington pool Conneaut field	497 Mcf AF 771 psi/142 hrs. development Orchard Beach North East field	602 Mcf AF 766 psi/140 hrs. development Orchard Beach pool North East field	320 Mcf AF 920 psi/2 days development Erie Deep field	366 Mcf AF 890 psi/10 days development Erie Deep field

COUNTY Permit Number	Erie 20529	Erie 20460	Erie 20509	Erie 20591	Erie 20459	Fayette 20200	Indiana 24201	Indiana 24321	Jefferson 21449	Lycoming 20026
NAME OF WELL	Robert Whitney #2	Kenneth & Shirley Wise #1	K. & S. Wise #2	Robert Wood #1	Yoder Bros., Inc. #1	Maude Mountain #1	L. Dudash #2-5242	Minta Forsha #1	B. N. Rhodes WN-1603	Fred Myers #1
OPERATOR	Envirogas, Inc.	N.E.A. Cross Co. Northwest Natural Gas Company	N.E.A. Cross Company	Envirogas, Inc.	Yoder Brothers, Inc.	Amoco Production & U.G.I. Corp.	Peoples Natural Gas Company	Felmont Oil Corporation	Consolidated Gas Supply Corporation	John H. Ware, III
TOWNSHIP	Harborcreek	LeBoeuf	Waterford	Harborcreek	Millcreek	Springfield	Young	Green	McCalmont	Anthony
QUADRANGLE & MAP NUMBER	North East D80 **Harborcreek	Union City D15 **Waterford	Union City D24 **Waterford	North East A120 **Harborcreek	Erie E133 **Swanville	Confluence B14 **Mill Run	Elders Ridge I54 **McIntyre	Barnesboro E40 **Commodore	DuBois G44 **Reynoldsville	Trout Run G7 **Salladasburg
LATITUDE	3,200 ft. S 42°10'00"	1,400 ft. S 41°55'00"	3,225 ft. S 41°55'00"	12,250 ft. S 42°12'30"	14,550 ft. S 42°07'30"	14,672 ft. S 40°00'00"	7,500 ft. S 40°32'30"	3,620 ft. S 40°40'00"	14,800 ft. S 41°05'00"	12,300 ft. S 41°20'00"
LONGITUDE	4,200 ft. W 79°55'00"	4,900 ft. W 79°55'00"	7,460 ft. W 79°55'00"	1,950 ft. W 79°55'00"	6,225 ft. W 80°07'30"	6,172 ft. W 79°22'30"	10,230 ft. W 79°17'30"	2,230 ft. W 78°52'30"	10,350 ft. W 78°55'00"	3,750 ft. W 77°10'00"
DATE COMPLETED	5-17-78	10-20-77	5-6-78	9-22-78	10-27-77	8-17-78	7-29-78	10-4-78	8-22-77	6-1-78
ELEVATION	860 GR	1189 DF	1235 GR	760 GR	740 DF	2338 KB	1390 GR	1690 KB	1815 KB	1286 KB
TULLY	*1412-1530	*2252-2323	*2334-2404	*1248-1358	*1320-1374	*7195-?	*7065-7116	*7309-?	*6532-6637	*5130-5285
ONONDAGA LIMESTONE	1630-	2478-	2559-	1466-	1530-	7777- Gas @7794-7874	7604-	8052- Gas @8070-8113	7050-	6734-
ONONDAGA CHERT						7790	7618-	8064-	7067-	
ORISKANY	Absent	Absent	Absent	Absent	Absent	7936- Gas @7940-7946	7752-	8161- Gas @8161-8165	7151- Show of gas	6803-
HELDERBERG	Absent	Absent	Absent	Absent	Absent	8028-	7774-	8180-	7156-	6870-
KEYSER-BASS ISLAND	1837-	2718-	2806-	1712-						
SALINA	2000-	2839-	2926-	1823-						
GUELPH-LOCKPORT	2348-	3337-	3422-	2179-						
BLACK WATER										
CLINTON	2600-	3566-	3647-	2444-	2540-					
IRONDEQUOIT	2656-	3672-	3757-	2491-						
MEDINA	2676- Gas	3702- Gas @3752-3824	3787- Gas @3830-3899	2525- Gas @2538-2626	2610- Gas @2655-2797					
WHIRLPOOL	2832- Gas	3870- Gas	3955- Gas	2663- Gas						
QUEENSTON	2850-	3882-	3965-	2682-	2800-					
TOTAL DEPTH	2927	3975	4021	2760	2900	8150	7870	8238	7174	6920
DEEPEST FORMATION REACHED	Queenston	Queenston	Queenston	Queenston	Queenston	Helderberg	Helderberg	Helderberg	Helderberg	Helderberg
RESULT	1,800 Mcf AF 887 psi/10 days development Erie Deep field	3,100 Mcf AF 1,150 psi/2 days development Erie Deep field	540 Mcf AF 1,120 psi/28 days development Erie Deep field	138 Mcf AF 755 psi/10 days development Erie Deep field	602 Mcf AF 880 psi/72 hrs. development Charter Oaks field	500 Mcf AF 3,588 psi/72 hrs. New field wildcat Mill Run field	Dry Hole Deeper pool test Lewisville field	2,000 Mcf AF 4,220 psi/24 hrs. extension Strongstown field	158 Mcf AF (shallow) 955 psi/14 days deeper pool test Panic field	Dry Hole extension Salladasburg field

Figure 30. *(Continued)*

COUNTY Permit Number	Lycoming 20025	Mercer 20160	Mercer 20164	Mercer 20150	Mercer 20146	Mercer 20161	Mercer 20138	Mercer 20131	Mercer 20170	Mercer 20148
NAME OF WELL	Robert Sulik #1	Anna Benic #1	Christy et al Unit #1	Hardesty-David Unit #1	Geiwitz Unit #1	Lawrence Gelesky #1	O. Marcucci Unit #1	Bruce & Bertha Metzger #1	Alex Oris #1	Rust-Scott Unit #1
OPERATOR	John H. Ware, III	Cyclops Corporation	Cyclops Corporation	Cyclops Corporation	Cyclops Corporation	Cyclops Corporation	Cyclops Corporation	Energy Services	Cyclops Corporation	Cyclops Corporation
TOWNSHIP	Mifflin	Hermitage	Hermitage	Hermitage	Shenango	Hermitage	Shenango	West Salem	South Pymatuning	Hermitage
QUADRANGLE & MAP NUMBER	Waterville I5 **Waterville	Kinsman I26 **Orangeville	Kinsman I27 **Orangeville	Kinsman I25 **Orangeville	Neshannock A6 **Sharon East	Youngstown C9 **Sharon West	Neshannock A8 **Sharon East	Shenango O11 **Greenville W.	Shenango G12 **Sharpsville	Kinsman I24 **Orangeville
LATITUDE	10,350 ft. S 41°17'30"	9,700 ft. S 41°17'30"	9,700 ft. S 41°17'30"	11,950 ft. S 41°17'30"	9,450 ft. S 41°12'30"	5,800 ft. S 41°12'30"	7,550 ft. S 41°12'30"	8,750 ft. S 41°25'00"	5,250 ft. S 41°17'30"	13,200 ft. S 41°17'30"
LONGITUDE	8,100 ft. W 77°15'00"	1,500 ft. W 80°30'00"	4,280 ft. W 80°30'00"	3,550 ft. W 80°30'00"	7,925 ft. W 80°27'30"	4,600 ft. W 80°30'00"	7,500 ft. W 80°27'30"	6,000 ft. W 80°27'30"	10,750 ft. W 80°27'30"	5,050 ft. W 80°30'00"
DATE COMPLETED	5-26-78	6-25-78	7-10-78	4-6-78	2-1-78	4-15-78	12-15-77	11-11-77	8-3-78	3-6-78
ELEVATION	1076 KB	1006 KB	1032 KB	974 KB	1007 KB	881 KB	840 KB	1256 GR	980 KB	1007 KB
TULLY	*5570-	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
ONONDAGA LIMESTONE	7068-	*3134-	*3142	*3101-	*3423-	3221-	*3247-	*3196-4652	*3104-	*3130-
ONONDAGA CHERT										
ORISKANY	7140- Gas	3326-	3332-	3289-	3620-	3414-	3442-		3304-	3310-
HELDERBERG	7208-	3342-	3354-	3304-	3635-	3428-	3458-		3324-	3320-
KEYSER-BASS ISLAND		3504-	3510-	3466-	3810-	3604-	3634-		3477-	3484-
SALINA		3580-	3594-	3543-	3888-	3670-	3700-		3560-	
GUELPH-LOCKPORT BLACK WATER		4386-	4390-	4357-	4672-	4464-	4446-		4340-	4394-
CLINTON		4620-	4655-	4636-	4920-	4708-	4742-		4605-	4628-
IRONDEQUOIT		4782-	4782-	4758-	5087-	4871-	4904-	4740-	4740-	4796-
MEDINA WHIRLPOOL		4869- Gas @4889-4928 5014-	4882- Gas @4883-5018 5012- Gas	4838- Gas @4846-4906 4988-	5160- Gas @5180-5234 5324-	4910- Gas @4983-5020 5106-	5001- Gas @5006-5058 5139-	4796- Gas @4806-4862 4898-	4836- Gas @4855-4974 4966-	Gas @4914-4934 5024-
QUEENSTON		5020-	5022-	4996-	5332-	5116-	5150-		4978-	5036-
TOTAL DEPTH	7264	5090	5090	5053	5370	5180	5191	4912	5050	5090
DEEPEST FORMATION REACHED	Herderberg	Queenston	Queenston	Queenston	Queenston	Queenston	Queenston	Medina	Queenston	Queenston
RESULT	40 Mcf AF 3,650 psi/10 days New pool discovery Tombs Run pool Salladasburg field	1,650 Mcf AF 1,475 psi/5 days development Sharon Deep field	1,300 Mcf AF 1,275 psi/40 days development Sharon Deep field	1,700 Mcf AF 1,500 psi/5 days development Sharon Deep field	1,380 Mcf AF 1,440 psi/72 hrs. development Wheatland field	1,150 Mcf AF 1,250 psi/84 hrs. development Wheatland field	1,600 Mcf AF 1,375 psi/5 days development Wheatland field	500 Mcf AF 1,365 psi/24 hrs. New field wildcat Maysville field	1,350 Mcf AF 1,250 psi/40 days extension Sharon Deep field	1,000 Mcf AF 1,200 psi/5 days development Sharon Deep field

COUNTY Permit Number		Mercer 20162	Mercer 20143	Mercer 20165	Mercer 20147	Potter 20552	Somerset 20068	Somerset 20068	Somerset 20069		
NAME OF WELL		Sheehan #1	J. Stefanowicz #1	Sykola-McCurdy Unit #1	Michael Vranich #1	David & James Leet #6212	Simon G. Engleka, Jr. #1	Jay W. Hemminger #1	James E. Spory #1		
OPERATOR		Pennzoil Company	Cyclops Corporation	Cyclops Corporation	Cyclops Corporation	National Fuel Gas Supply Corporation	Amoco Production & U.G.I. Corp.	Amoco Production & U.G.I. Corp.	Amoco Production & U.G.I. Corp.		
TOWNSHIP		French Creek	Shenango	South Mahoning	Hermitage	Allegany	Somerset	Somerset	Conemaugh		
QUADRANGLE & MAP NUMBER		Stoneboro C21 **New Lebanon	Neshannock A7 **Sharon East	Kinsman I28 **Orangeville	Kinsman I23 **Orangeville	Genesee D184 **Sweden Valley	Meyersdale B7 **Murdock	Meyersdale B8 **Murdock	Somerset C36 **Boswell		
LATITUDE		13,825 ft. S 41°30'00"	8,600 ft. S 41°12'30"	7,600 ft. S 41°17'30"	14,000 ft. S 41°17'30"	800 ft. S 41°52'30"	5,150 ft. S 40°00'00"	8,350 ft. S 40°00'00"	1,900 ft. S 40°15'00"		
LONGITUDE		10,525 ft. W 80°02'30"	5,750 ft. W 80°27'30"	3,930 ft. W 80°30'00"	2,900 ft. W 80°30'00"	7,000 ft. W 79°55'00"	7,150 ft. W 79°05'00"	9,050 ft. W 79°05'00"	50 ft. W 79°00'00"		
DATE COMPLETED		5-5-78	1-15-78	7-19-78	2-26-77	6-6-78	10-13-77	9-6-78	9-27-78		
ELEVATION		1325 GR	1183 KB	1103 KB	944 KB	2160 GR	2093 KB	2134 GR	1855 KB		
TULLY		*3510-3585	Absent	Absent	Absent	*4972-5576	*7677-	*7682-7720	7926-		
ONONDAGA	LIMESTONE	3707-	*3305-	*3212-	*3073-	5576-	8540-	8572-	8675-		
	CHERT						8559-	8588-	8691-		
ORISKANY		3859-	8798-	3412-	3256-	5592-	8622- Gas @8676-9014	8692- Gas @8726-8820	8790-		
HELDERBERG		3893-	3512-	3434-	3274-	5608-	8800?-	8880?-	8950?-		
KEYSER-BASS ISLAND			3650-	3590-	3400-		9057-				
SALINA		3996-	3688-	3675-							
GUELPH-LOCKPORT		4760-	4760-	4440-	4366-						
BLACK WATER											
CLINTON			4803-	4714-	4588-						
IRONDEQUOIT		5160-	4968-	4842-	4746-						
MEDINA		5175-	5044- Gas @5077-5155	4925- Gas @4942-4978	4828- Gas @4832-4932						
WHIRLPOOL			5202-	5067-	4976-						
QUEENSTON		5360-	5214-	5078-	4988-						
TOTAL DEPTH		5402	5234	5140	5040	5680	9198	8902	8966		
DEEPEST FORMATION REACHED		Queenston	Queenston	Queenston	Queenston	Helderberg	Keyser-Bass Island	Helderberg?	Helderberg?		
RESULT		Dry Hole Deeper pool test Milledgeville field	1,108 Mcf AF 1,425 psi/60 hrs. development Wheatland field	1,250 Mcf AF 1,200 psi/40 days development Sharon Deep field	1,666 Mcf AF 1,275 psi/72 hrs. deeper pool discovery Sharon Deep field	Dry Hole extension Champlin pool Hebron field	4,100 Mcf AF 3,961 psi/45 hrs. New field wildcat Somerset West field	2,600 Mcf AF 3,768 psi/72 hrs. development Somerset West field	250 Mcf AF 3,200 psi/14 days development Heckman Hollow field		